THE UNIVERSITY OF CHICAGO PRESS JOURNALS

The Medieval Academy of America

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Source: *Speculum* , Oct., 1929, Vol. 4, No. 4 (Oct., 1929), pp. 390-410

Published by: The University of Chicago Press on behalf of the Medieval Academy of America

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THE ORGAN IN THE EARLY MIDDLE AGES

By HELEN ROBBINS BITTERMANN

THE chroniclers to the contrary,[1] the first organ brought into Western Europe was not the one included among other gifts sent to Pepin, King of the Franks, by messengers from the eastern Emperor, Constantinus Copronymus, in 757. For two centuries at least, the organ had been used in connection with the church service in Gaul; [2] and for six centuries before that, it had been in demand as a solo instrument on feast days and on similar occasions in the Roman Empire.[3] Emperors had improvised on it.[4] It had blared paeans of victory for successful contestants in the games.[5] Wealthy men had eaten their dinners to its noisy accompaniment.[6] Poets

[1] Thus the *Annales Mettenses Priores*, anno 757 (ed. B. Simson, p. 49). Cf. *Annales regni Francorum*, anno 757 (ed. F. Kurze, p. 14); *Annales Laurissenses*, anno 757 (*Mon. Germ. Hist., SS.*, I, 140); *Annales Sangallenses Maiores* (*ibid.*, 74).

[2] Fortunatus, *Carmina*, ii, 9 (*Mon. Germ. Hist., AA.*, XI, 39) and *Carmina*, iii, 9 (*ibid.*, 60); also his life of St Germain, bishop of Paris, c. 14 (*Mon. Germ. Hist., SS. Rer. Mer.*, VII, 382); *Vita Sollemnis Episcopi Carnoteni* (*ibid.*, 316, l. 10); *Vita Caesarii Episcopi Arelatensis* (*ibid.*, III, 496); *Vita Landeberti Episcopi Traiectensis Vetustissima* (*ibid.*, VI, 379 ff.); *Vita Desiderii Episcopi Viennensis* (*ibid.*, VII, 644). For references to its early use in England, see the *Vita Wilfridi I Episcopi Eboracensis Auctore Stephano* (*ibid.*, VI, 201), and Aldhelm's riddle on the organ in J. H. Pitman, *The Riddles of Aldhelm* (Yale Studies in English, LXVII, 1925), p. 101. Erika von Erhardt-Siebold has commented upon the latter in *Die Lateinischen Rätsel der Angelsachsen* (Heidelberg, 1925), pp. 120–131. See also the fourth stanza of the hymn on the martyrdom of Gengulf (*Mon. Germ. Hist., SS. Rer. Mer.*, VII, 170).

[3] Petronius, *Satyricon*, c. 36 (ed. F. Bücheler, Berlin, 1904, p. 24); Caius Lucilius, *Aetna*, ll. 292–299 (Siegfried Sudhaus, *Aetna erklärt*, Leipzig, 1898, pp. 20–21); Tertullian, *De Anima*, c. 14 (*Opera Omnia* (ed. Franz Oehler, Leipzig, 1853–54), II, 576); St Augustine, *Commentary on Psalm 56* (*Patr. Lat.*, XXXVI, 671) and *Commentary on Psalm 150* (*ibid.*, XXXVII, 1964); Claudian, *Panegyricus Dictus Manlio Theodoro Consul* (*Mon. Germ. Hist., AA.*, X, 187, l. 311 ff.); *Epithalamium Laurentii* (*ibid.*, 406).

[4] Suetonius, *De Vita Caesarum*, vi, 41 (Loeb Classical Series, p. 164); *ibid.*, vi, 54 (*ibid.*, p. 182); 'Heliogabalus,' c. 32 (*Historiae Augustae Scriptores* (ed. H. Peter, Leipzig, 1865), I, 225); 'Alexander Severus,' c. 27 (*ibid.*, I, 247); 'Gallienus II,' c. 46 (*Ibid.*, II, 87).

[5] For reproductions of contortionates of Nero's reign on which victors of such contests are represented as standing by hydraulic organs and holding fans or *flabelli*, see C. F. Abdy Williams, *The Story of the Organ* (London, 1903), pp. 4, 5; *ibid.*, Appendix A, p. 207.

[6] Sidonius Apollinaris complimented Theoderic II for the simplicity of his meals, adducing as evidence that 'there was no noise of hydraulic organ, or choir with its conductor intoning a set piece,' which would seem to indicate that such had been the practice. (*Epistolae*, i, n. 2 (*Patr. Lat.*, LVIII, 449).)

mentioned it in their songs.[1] So it is no novelty imported into the west from Byzantium with which we are dealing, but an instrument well known to the musicians of the Roman Empire.

Form of the Early Mediaeval Organ

It must not be imagined that these organs resembled the modern instrument in form or in sound. The nearest modern approximation would be a calliope. Indeed, the first instrument was nothing more than an inverted vase, open at the top, to which a trumpet was attached. When water was pumped into the vase, air was forcibly driven through the trumpet, which gave out a blast of sound. This was the invention of Ctesibus, a barber living in Alexandria in the second century B.C.[2] Such was the principle of the hydraulus, the first actual organ devised. Its inventor was a pupil of Ctesibus, Hero of Alexandria.[3] And such remained the principle of the hydraulus.

The pipes were arranged upright in a row and were held in that position by a cross bar. They stood over a channel of water which, when agitated, forced air out of all the pipes at once. The method of playing was to close all pipes but the one to be sounded, by the palms of the hands. This is the type of organ described by Julian the Apostate in his epigram on the organ. He said:

A strange growth of reeds[4] do I behold. Surely they sprang on a sudden from another brazen field, so wild are they. The winds that wave them are none of ours, but a blast leaps forth from a cavern of bull's hide

[1] Fortunatus, 'De nauigio suo,' *Carmina*, x, 9, l. 53 (*Mon. Germ. Hist.*, *AA.*, xi, 243); Corippus, *In Laudem Iustinii*, iii, l. 72 (*ibid.*, iii, 139), and *Iohannides*, iv, l. 577 (*ibid.*, 51).

[2] Vitruvius, *De Architectura*, ix, 1 (Leipzig: Teubner, 1912, pp. 218, 219).

[3] *Pneumatica et Automata*, i, 42 (W. Schmidt, *Herons von Alexandria Druckwerke und Automatentheater* (Leipzig, 1889), i, 193). Hero also devised an organ dependent for power on a small windmill.

[4] It should be explained that this is a play on words. As the Latin *canna* (reed) was also used for 'organ pipe,' regardless of the material used, so here the term means both 'reed' and 'pipe.' It is this fact which has led to misapprehension on the part of translators. Although I have used W. C. Wright's translation for the most part, I have had to take the liberty of changing the last sentence. Wright's sentence read originally: '. . . stands there and handles the keys that pass the word to the pipes; then the keys leap lightly, and press forth the melody.' Here *κανόνας* should be taken in its original meaning, 'rod' or 'pipe,' to give a proper picture.

and beneath the well-bored pipes travels to their roots. And a dignified person, with swift-moving fingers of the hand, stands there and feels the yielding rods of pipes, and they, gently dancing, press out song.[1]

The limitations of such an instrument must have been trying to the performer. Indeed, it is to be wondered that the organ became popular at all. The number of notes possible was few, at the most seven or eight.[2] This meant at once that the instrument was limited in size,[3] and that the variety of tones was not great. Such tones as there were must have been harsh and shrill, totally unlike any tone now associated with the organ. In the first place, the pipes were relatively small in diameter and short, in order that the performer might shut off more or less completely the air in all the pipes but those to be sounded. This meant that the tones produced were of necessity high in pitch. In the second place, the abrupt, forcible escape of air from the pipes precluded any possibility of a mellow, sweet tone. Indeed, the resemblance of this early type of organ to the modern bagpipe, in tonal quality, at least, would be striking. There would be this difference, however: whereas the bagpipe is capable of sounding a sprightly air, this early organ was confined to melodies of a slow, measured rhythm. Variation here would be very awkward of achievement, if not impossible. Yet, if variety of tone and measure were not possible, it must not be thought that performances on the organ were fraught with monotony. Whatever the range of melody or tempo, there was ever present the danger of uneven pressure in the pipes. Now, an organ pipe will rise in pitch from one to two octaves, be the pressure increased ever so slightly. Similarly, if the pressure is decreased, the pitch will fall. The hazards involved in trying to follow a set melody must have introduced an element of adventure into the performance of the simplest scale. It is this fact which makes it almost certain that this organ was used only as a solo instrument, particularly since Greek and Roman music was

[1] *Opera*, iii, 306 (Loeb Classical Library, transl. W. C. Wright).

[2] The hydraulus of Hero had eight pipes, as does the instrument reproduced by Williams, *op. cit.*, pp. 4, 5.

[3] Athanaeus refers to a small portable organ capable of being transported from place to place: *Deipnosophistae*, iv, 174a (ed. and transl. C. B. Gulick, Loeb Classical Library, *Athanaeus*, II (1928), 290, 291).

largely melodic and not harmonic in form.[1] Where pressure was so uncertain, accompaniment on an hydraulus of the primitive type would have been a hazardous undertaking and extremely disconcerting to the soloist.

In time, changes were made which remedied the more serious faults of this early instrument. The most serious problem, the provision of a keyboard, had been solved as early as the first century A.D. by Vitruvius.[2] This organ was not immediately adopted to the exclusion of the old. As late as the fourth century, Julian the Apostate described an instrument of the more primitive type. However, the new model persisted,[3] and no essential changes were made in its construction until the end of the eleventh century. The mechanism of the organ described by Vitruvius is practically identical with that furnished by Theophilus and Ruger, who wrote in the latter part of the eleventh century.[4] It is true that an attempt was made, probably in the fourth century, to produce a more even pressure in the pipes by abolishing the use of water and by substituting a pair of bellows to furnish air pressure. In this type of organ, one of the pair would act as an air reservoir while the other forced the air through the pipes. Coussemaker reproduces such an organ, represented on an obelisk erected by Theodosius the Great.[5] Grove's *Dictionary of*

[1] César Saerchinger, 'The Music of the Ancient Greeks,' *The Art of Music* (New York: National Society of Music, 1915), I, 97; Guido Alder, *Handbuch der Musikgeschichte* (Frankfort-am-Main, 1924), p. 31.

[2] *Loc. cit.*

[3] H. J. Moser describes the finding of a mosaic at Neming bei Sierck on the Mosel which dated from the second century. On it was pictured a hydraulus with twelve pipes: *Geschichte der Deutschen Musik* (Stuttgart: J. B. Cotta, 1926), p. 59. A hydraulus was also discovered in the ruins of Carthage. It was made in A.D. 120 by the potter Possessor, whose name is inscribed on its side. The instrument is now in the Musée Lavigérie at Carthage (F. H. Martens, 'The Organ from the Earliest Times to the Present,' *The Art of Music*, VI, 398).

[4] *Theophili et Rugeri Presbyteri et Monachi libri III, de Diuersis Artibus* (ed. R. Hendry, London, 1847). An English translation of the treatise on organ building is found in G. A. Audsley, *The Art of Organ Building* (London, 1905), I, 23 ff. The page references to the treatise which will follow, will be to this translation.

Of the earlier improvements of the organ we know little. Archimedes seems to have made some (Vitruvius, *op. cit.*, i, 1; Tertullian, *loc. cit.*). Kathleen Schlesinger has shown that the germ of many of the most important parts of the organ had been discovered before the Christian era ('Researches into the Origins of the Organs of the Ancients,' *Sammelbände d. Int. Mus. Ges.*, II (1900–01), 167 ff).

[5] 'Essai sur les Instruments au Moyen Age,' *Annales Archéologiques* (Paris, 1845), II, 277.

Music shows a similar pneumatic organ, now at the Museum of Arles, which dates from the ninth century.[1] So the pneumatic organ seems to have been at least in existence in these early centuries.[2] Yet its existence is not of great importance. The mechanism both of the hydraulus and of the pneumatic organ was essentially the same except for the means adopted for the creation of an even air pressure.

The invention of the keyboard had far-reaching consequences, whether the instrument to which it was attached were hydraulus or pneumatic organ. It made possible the inclusion in the range of the instrument of all the notes then used, and increased the volume of the tone produced from two to three times. Since the change effected was so tremendous, it might not be amiss to describe it. The lower end of each pipe was enclosed in a small, shallow box. The bottom of each box was movable, sliding in grooves cut for the purpose. In this slide, there was a hole corresponding exactly in size to the pipe inserted in the box. When the slide was pushed in, the hole fitted under the lower orifice of the pipe, thus permitting air to be forced into the pipe, which then sounded. In this way, the pipes could be controlled separately. The slide was returned to its place by a spring, on the removal of the finger. In order that the slide might not be drawn out too far, a copper-headed nail was fixed immediately behind the tongue or handle of the slide. Such was the mechanism of the organ from the time of Vitruvius to the last half of the eleventh century.[3]

Now, what did this mean? *Imprimis*, the range of the organ was no longer restricted to the number of pipes which could be covered

[1] 3d ed., H. C. Colles, III, 736.

[2] It is thought that the organ described by St Augustine was of the pneumatic variety since no mention is made of the hydraulic apparatus: 'All musical instruments are called organs. Not only is that instrument called an organ which is large and blown by bellows, but also whatever one is adapted for song . . . is called an organ' (*Patr. Lat.*, XXXVI, 671).

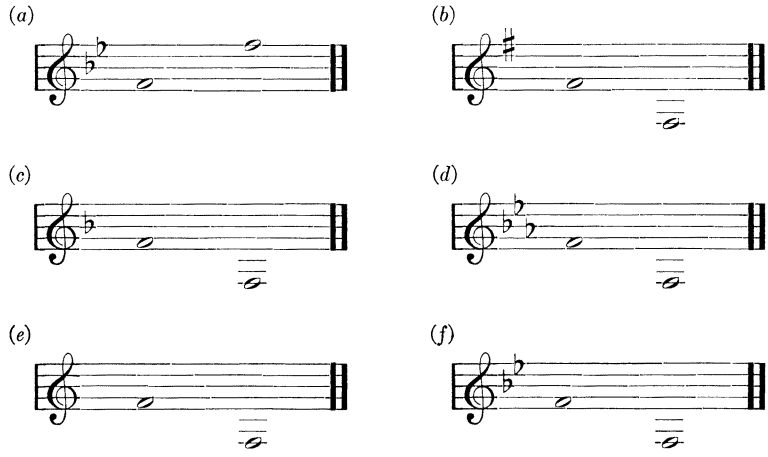
[3] Compare the descriptions of Vitruvius (*loc. cit.*) and of Theophilus and Ruger (see n. 4, p. 393 above). It will be noticed that whereas Vitruvius uses a spring made of bone, Theophilus and Ruger have advanced to a spring made of metal. See also the description of an organ attributed to Bede in the eighth century in the *Interpretatio Psalterii Artis Cantilenae* included among the *Opera Dubia et Spuria* (*Patr. Lat.*, XCIII, 1102C), and the passage in the *Musicae Disciplinae*, cap. 3 of Aurelian of Réomé (Martin Gerbert, *Scriptores Ecclesiastici de Musica, Sacra* (St Blasien, 1784), I, 33, col. 1).

by the palms of the player. In the model of Vitruvius' organ reconstructed by the Rev. F. W. Galpin,[1] there are nineteen pipes, which accommodate the six modes described by *Anonymous*.[2] This is obviously the instrument described by Optatian:

These verses are the form of the instrument on which one can bring forth variegated songs, and whose sounds escape from round, open pipes of brass, and whose length increases regularly. Below the pipes are placed the levers [3] by which the hand of the artist, opening or closing at will the conduits of wind, gives out a well-rhythmed, agreeable melody. Water, placed beneath the pipes and agitated by air pressure, which takes the labor and efforts of several youths, gives the necessary assorted sounds to the music. At the least movement, the levers, opening the pipes, can express

[1] For a description and plates of Galpin's organ, see Williams, *op. cit.*, Appendix B, pp. 210–213, and his *Story of Organ Music* (London, 1905), p. 5, n. 1. The latter reference is to 'An Exhibition of Musical Instruments, Manuscripts, and Printed Books, held in 1904 by the Worshipful Company of Musicians at Fishmongers' Hall,' at which Galpin exhibited and played his instruments.

[2] Fr. Bellermann, ed., *Anonymi Scriptio de Musica* (Berlin, 1841), p. 36. The modes in their diatonic form would be roughly represented by the modern scales with the following signatures:



(*a*) Hyperlydian; (*b*) Hyperiastian; (*c*) Lydian; (*d*) Phrygian; (*e*) Hypolydian; (*f*) Hypophrygian.

[3] The Latin term is *plectra*, which has the literal meaning of a 'short stick with which the strings of a stringed instrument were struck.' Apparently the term *lingua*, later used to designate the sliders, had not yet come into use. *Linguae* remained the technical term to describe the sliders until the end of the eleventh century, when the spring-box mechanism superseded the slider-box.

rapid and vigorous songs, or a calm and simple melody, or yet again, by the power of rhythm and melody, can inspire a religious terror.[1]

In this case it is an hydraulus which is being described. As for the pneumatic organ, there is the description commonly attributed to Bede:

> The organ is built like a tower out of divers pipes from which a very rich voice is produced by a blast from the bellows, and in order that a seemly modulation may order it, it is built with certain wooden tongues (protruding) from the interior which, when the trained fingers of the masters restrain them, produce a sublime, sweet song.[2]

Such an arrangement was a great improvement over the more primitive type of organ. Instead of being confined to seven or eight tones, the entire range then in use was available. To us, two octaves would seem a painfully limited scope with which to deal. But to the ears of the mediaeval man, they sufficed; and many are the references to the delightful music they produced.[3]

The monotony of the early organ music was decreased not only by an increase in the number of notes available, but also by the variation in tempo now possible. No longer was the artist confined to the slow, stately melodies inevitable when only one note at a time was allowed to escape from the set of pipes before him. Optatian tells us of 'rapid and vigorous songs' which are 'well-rhythmed.' This description is of great significance. Disregarding for the moment the great swiftness of execution possible under the new arrangement, the fact that a melody could be 'well-rhythmed' is of momentous importance in the development of organ music. Melodies played on the primitive organ could not have had rhythm as we understand it to-day. Each note must have had a value almost equal to that of every other note. The changes in rhythm which make for variation

[1] *Patr. Lat.*, XIX, 429, 430. See also Cassiodorus i, *Epistola*, no. 45 (*Patr. Lat.*, XLIX, 510A).

[2] *Loc. cit.* See also his *Didascalia Genuina* (*Patr. Lat.*, XC, 140) and the *Musica Practica* among his *Opera Dubia et Spuria* (*ibid.*, 922B).

[3] In this connection, it may be interesting to note that as late as Palestrina (d. 1594), the range of notes for any single voice was limited. Palestrina usually confined himself to an interval of nine notes for any one voice. See for example, his *Adoramus Te* (ed. Gustav Schirmer, no. 6091) or his *Sicut Cervus* (*ibid.*, no. 3509).

could not have been possible with the organ described by Julian the Apostate. But with the slider-box arrangement, a quick, irregular change could be made from slider to slider, and a well-defined rhythm could be attained. I use the term 'could' advisedly. It must have been no mean task to attain perfection on such an instrument. Each slider resembled its fellows. There were no 'black' keys to orient the player, and the practice of lettering the sliders did not come into use before the eleventh century.[1] Yet once the 'geography'

[1] The organ of Theophilus and Ruger was thus lettered (*op. cit.*, c. 82, p. 25). The use of letters to indicate the notes of the scale is usually attributed to Guido d'Arezzo (see his *De Disciplina artis musicae* in Martin Gerbert's *Scriptores*, II, 4). However, F. Salvador-Daniel, *The Music and Musical Instruments of the Arab* (ed. H. G. Farmer, London, 1914), p. 49, and after him, H. G. Farmer (*ibid.*, n. 38, p. 241), believe that Guido merely abbreviated the names formerly used, which were the first letters of the Arabic alphabet: *alif*, *ba* or *bim*, *gim*, *dal*, *hé*, *vau*, and *zaïn*. The practice of lettering sliders persisted at least until the fifteenth century. Michael Praetorius reproduces the keys of the Brunswick organ dating from 1456 and so lettered (*Syntagma Musicus*, 1618, reprinted 1884, II, 117).

The claim that the Arabs also introduced the *solfeggio* is of long standing. (For writers adhering to this position, see H. G. Farmer, 'The Arabian Influence on Musical Theory,' *Journal of the Asiatic Society*, London, 1925, Part I, p. 8, n. 2.) Farmer states, however, that he is unable to trace this material in any of the Arabian musical manuscripts which he has consulted. He says, 'In comparing the names of the Arabic notation with that of the European *solfeggio*, one cannot help being struck with the phonetic likeness. At the same time, the present writer has not seen any other example of the Arabic alphabet used in this sequence for musical notation.' (*ibid.*, 9). He then gives the Arabian form and that attributed to Guido:

Arabian	— Mîm	Fâ	Sâd	Lâm	Sîn	Dôl	Râ
Guidonian	— Mi	Fa	Sol	La	(Si)	Do / Ut	Re

The usual tale is that Guido found those particular syllables by taking the first syllable of each line of a hymn writtten by Paul the Deacon for the festival of St John the Baptist. Thus:

UT queant laxis
REsonare fibris
MIra gestorum
FAmuli tuorum
SOLue polluti
LAbii reatum
Sancte Ioannes

While granting the possibility that such actually was the case, it would seem to me more logical to assume that Guido, in some fashion aware of the solmistic use of those letters of the Arabian alphabet, used Paul's hymn as a memory device, and in so doing, changed Do to Ut. Gerard Vossius mentioned the following distich as having been written shortly after the time of Guido in order to impress the syllables upon the mind of the learner:

'Cur adhibeo tristi numeros cantumque labori?
UT REleuet MIserum FAtum SOLitosque LAbores.'

of the keyboard was mastered, swift execution was possible.[1] So Claudian says: 'Who, with a light touch, produces great sounds, calls forth with a wandering finger the innumerable voices of the brazen field, and through a beam-like lever within, rouses the laboring waters to song.[2]

But not only was range increased, but volume also. By placing more than one pipe on each slider, the sound could be increased in direct proportion to the number of pipes added.[3] How successful these organs were in increasing the volume of sound poured out, we may judge from numerous sources. An Arabian writer, Ikhwân al-Safâ, said that it was a terrible thing to hear, so terrible that the Byzantines used it in time of war to disconcert the enemy.[4] There is also the classic reference of Ammianus Marcellinus, who bears witness to the tendency to build 'bigger and better' hydrauli in the fourth century — an attempt by no means limited to organs, if we may believe that historian.[5] Of interest, also, in this connection, is the letter to one Dardanus, attributed to Jerome.[6] Entitled *De Diversibus Generibus Musicorum*, it contains the description, among other instruments, of an organ reputed to be in Jerusalem. This remarkable instrument had twelve pairs of bellows, fifteen pipes of bronze, a wind reservoir made of two elephant hides, and possessed the faculty of being heard at a distance of a thousand paces — in

(*De Quatuor Artibus Popularibus* (Amsterdam, 1650), cited in Grove's *Dictionary of Music and Musicians*, III, 804.)

Now it seems to me that the hymn of St John the Baptist, like this distich, formed a happy mnemonic device. Why otherwise should Guido have selected that particular hymn or those particular syllables? Although Farmer has found no other reference to such a deliberate use of the Arabian alphabet, until further revelation I prefer to consider the syllables used by Guido as an adaptation of the Arabian, and his use of Paul's hymn a mnemonic device rather than the origin of the European *solfeggio*.

[1] Williams' account of Galpin's performance on his hydraulus substantiates this statement (*The Story of the Organ*, p. 5).

[2] *Panegyricus Dictus Manlio Theodoro Consul* (*Mon. Germ. Hist., AA.*, X, 187, l. 311 ff.).

[3] In the organ described by Theophilus and Ruger (p. 393, n. 4 above), two or three pipes were used for each note.

[4] H. G. Farmer, 'Byzantine Musical Instruments in the Ninth Century,' *Journal of the Royal Asiatic Society* (London, 1925), Part II, p. 6. See also his *Two Eastern Organs* (London: Harold Reeves, 1928), p. 28. For combinations of chords on the organs used by the Muslims to obtain divers emotional effects, see *ibid.*, p. 35.

[5] *Rerum Gestarum*, XIV, 6, 18 (ed. Charles Clark, Berlin, 1910, I, 16).

[6] *Patr. Lat.*, XXX, 219.

other words, of being audible at the Mount of Olives when played in Jerusalem. One cannot take such a description too seriously.[1] Its chief importance lies in the fact that it would indicate that large organs were being built in the fourth century and that they possessed a greater value of tone than those constructed prior to the invention of the slider-box organ. However, one must not assume that organs built prior to the fourth century were always small, portable affairs. The evidence we have points to instruments of good size,[2] and we may be specific at least in one instance. Judging from the reproduction of the hydraulus built by Possessor in the second century, which is $7\frac{1}{16}$ inches by $2\frac{3}{4}$ inches, it must have been about 10 feet by 4 feet.[3]

The reader may feel that overmuch space has been devoted to description of the organ of the early Christian centuries. But such a procedure seems essential, since the organ of those early centuries remained the organ of the early Middle Ages. It is now clear that the early mediaeval organ was of three types. There was the model which had no keyboard and which must have been used as a solo instrument because its accuracy of tone was highly problematical. This organ was capable of producing music only of a slow, measured, monotonous type, because the performer had at his disposal but seven or eight notes and because the nature of the instrument made the reproduction of a rhythmed melody exceedingly awkward. The notes played were probably of equal value. This type of organ persisted down to the fourth century, being gradually replaced by the

[1] It is amusing to note how seriously this description was taken by the later mediaeval writers. For example, Hrabanus Maurus practically copied the passage verbatim and presented it as a picture of the organ of the Hebrews (*De Uniuerso*, xviii, 4, in *Patr. Lat.*, cxi, 496 D). In addition, he copied the allegorical interpretation placed upon it by Jerome, namely, that the two elephant hides represented the Old and the New Testaments, the twelve bellows the apostles, and the fifteen pipes the patriarchs and the prophets, and elaborated still further upon the theme. This tendency to use elaborate allegorical figures in mediaeval literature should be emphasized; since many writers, following Martin Gerbert (*De Cantu et Musica Sacra a Prima Ecclesiae Aetate usque ad Praesens Tempus* (Saint Blasien, 1774), i, 212), belittle the importance of such a description as Jerome's purely on the ground of its allegorical treatment. In view of the almost universal habit in the Middle Ages of speaking in allegory, such a judgment seems illogical.

[2] See above, p. 390, n. 5; p. 393, n. 5, and 394, n. 1; p. 395, n. 1.

[3] See p. 393, n. 3, above.

other two types. These were alike in their construction except in the method used to provide air pressure. The one, which used a system of water pressure, was called an hydraulus; the other, which depended on two (or more) pairs of bellows, was called a pneumatic organ. On both of these organs, the execution of a rhythmed melody was made possible since the use of sliders permitted the performer to vary the value of the notes played. Varying tempos were used, and the volume of tone produced probably approached that of the modern organ, whose roll is so characteristic that it is difficult for the modern mind to conceive of an organ without the 'organ tone.'

Until the eleventh century there was no variation in tone in the pipes themselves. They were made chiefly of copper,[1] brass,[2] or wood,[3] which was sometimes gilded.[4] But there is no evidence prior to the eleventh century that the various metals were mixed in order to obtain different qualities of tone.[5] We may thus imagine an organ, say from the fourth to the eleventh centuries, as possessing a pure 'organ tone' capable of great crescendos and of delicate diminuendos and also capable of producing music with rhythm and of variable tempo. In short, the early mediaeval organ sounded not unlike those to which our grandfathers were accustomed, if we exclude all tonal qualities but that known as the 'diapason.'

[1] *Vita S. Oswaldi Archiepiscopi Eboracensis*, xxvii, 66 (AA SS, VII, *saec.* v, 734). See also Theophilus and Ruger, *op. cit.*. c. 82, p. 24.

[2] Cf. the descriptions of Julian the Apostate, p. 391 above, and of Optatian, p. 395 above.

[3] Theophilus and Ruger, c. 82, p. 24.

[4] Aldhelm, *De Laudibus Virginum*, l. 73 (ed. R. Elwald, *Mon. Germ. Hist., AA.* (Berlin, 1919), xv, 356; *ibid.*, in *Patr. Lat.*, LXXXIX, 240 B).

[5] Although Theoderet noted that a change in materials of the pipes produced a change in tonal quality (*De Prouidentia Oratio*, iii, in *Patr. Graec.*, LXXXIII, 590 A), there seems to have been nothing definitely constructed with such a principle in mind until the eleventh century. In the treatise of Theophilus and Ruger, it is indicated that different finishes of the pipes would produce different qualities of tone (c. 82). Also, it was known at that time that a fuller tone could be produced by a wide opening in the pipe, whereas a more delicate sound was produced by a narrower one (*ibid.*). However, I have not been able to discover the use of such a principle prior to this statement of the eleventh century.

The Place of the Organ in Mediaeval Ritual

Now that the general form and tone of the early mediaeval organ have been established as best they may be under the circumstances, let us turn to the uses to which this instrument was put. Of its secular use, something is known. Sidonius Apollinaris mentioned it as a solo instrument at dinners.[1] Corippus indicated it in connection with other instruments,[2] as did the writer of the *Epithalamium Laurentii*,[3] a contemporary of Claudian's, who enumerated it with other instruments employed in a wedding procession. Sedulius Scottus in the ninth century also indicated it as an instrument to be used on joyful occasions.[4] So it seems that in secular uses in the Roman Empire and during the Middle Ages, the organ was employed both as a solo instrument and in connection with other instruments. The greatest use of the organ in secular fêtes seems to have been in Byzantium. In the Western Empire, after the sixth century, references to the organ in civil ceremony are scarce, and there is little to be found outside of definitions, descriptions, vague allusions, and occasionally a reference to its use in connection with the church service. In Byzantium, however, the organ seems to have replaced the orchestra in the great civil ceremonies.[5] Thus, in a fête given by Constantine Porphyrogenitus (913–959) for the Saracen ambassadors, the opening phrases of each musical composition were sounded by organs of gold and of silver.[6] The organ did not accompany the voices, which performed *a capella*, but played a sort of introduction. Again, according to Thibaut, the ceremonial of the Byzantine emperors contains several mentions of the organ. Apparently the instrument was used in the circus to herald the entrance or exit of the emperor and to do homage to Blues or Greens. This information is quite in accord with what has already been found on the subject. Theodosius apparently had an organ,[7] and the two old organs of

[1] See p. 390, n. 6 above.
[2] See p. 391, n. 1 above.
[3] *Mon. Germ. Hist., AA.*, x, 406.
[4] *Carmina*, ii, no. 28 (*Mon. Germ. Hist., PP.*, iii, 192).
[5] P. Johannès Thibaut, *Revue d'Histoire et de Critique Musicales*, i (1901), no. 4, 174–175.
[6] *Ibid.*
[7] See p. 393 above.

Theophilus (*ca.* 829) were remarkable enough to excite comment many years later when Constantine Manasses made mention of them in his *Compendium Chronicon*.[1] Reference has already been made to the many other passages concerning the organ in Roman times.

But what was the position of the organ in the mediaeval church? It is commonly held that the organ was first introduced into the mass by Pope Vitalian in the seventh century. This assertion was first made by Platina in his *De Vita et Moribus Summorum Pontificum Historia*,[2] and was incorporated by Praetorius into his *Syntagma Musicus*.[3] From there the tradition spread into most reputable histories of music, although Coussemaker indicated that he considered such an interpretation of the phrase 'as they wished' (ut quid uolant) dubious and took issue with the reading.[4] The tradition is charming, but unfortunately not authentic. The organ was used in connection with church services as early as the sixth century. And since no distinction was made between the organ and other instruments, it will not be amiss to indicate the status of instruments in general in the church service in the preceding centuries.

It seems fairly clear that in the early church, that is, prior to the fourth century, what service there was, was extremely simple in form and was largely unaccompanied by musical instruments. Clement of Alexandria, writing in the second century, said that only one instrument, the Word of God, was to be used in honoring him.[5] And Justin Martyr said definitely that instruments were excluded from the church, only the simple chant being allowed.[6] At this time, when Christianity was a forbidden religion, and Christians a persecuted sect, there was good reason for keeping the religious assemblies simple and inconspicuous.[7] But in the fourth century the situation

[1] *Patr. Graec.*, CXXVII, 400.

[2] 1530, p. 99: 'But Vitalian being intent upon divine worship, composed an ecclesiastical rule and ordered the singing, joining to the consonance (as they wished) the organ.'

[3] II, 107.

[4] *Ibid.*, 278.

[5] *Paedagogi*, ii, 4 (*Patr. Graec.*, VIII, 442).

[6] *Quaestiones et Responsiones ad Orthodoxos*, § 107 (*Patr. Graec.*, VI, 1354).

[7] There seems to be reason to suppose that even at this early date instruments were used to accompany the prayers. Papadopoulos makes this inference, although he does not say on what sources he bases his judgment (G. Papadopoulos, *Ἱστορικὴ ἐπισκόπησις τῆς βυζαντινῆς ἐκκλησιαστικῆς μουσικῆς ἀπο τῶν ἀποστολικῶν χρόνων τῶν καθ' ἡμᾶς* (Athens, 1904), p.3).

changed. Christianity became a *religio licita*, and restraint gave way to widespread extravagance.[1] The movement toward decoration and ornamentation did not stop with the interior of the church, but made itself felt in the very service itself.[2] The early Fathers substantiated this statement. It seems to be true that the tendency was to eliminate any type of music which would turn the mind toward worldly thought or make an appeal to the senses. Thus, St Augustine, in discussing the use of psalms in the service, is dismayed to find himself swayed by the music rather than by the thought portrayed, and censures himself severely for having yielded to a sensuous pleasure.[3] But in the time of Athanasius, the group of heretics called Miletians accompanied hymns by a clapping of hands and dance movements,[4] a custom usual in the East. Eusebius speaks of the use of musical instruments, the cithara in particular, as an accompaniment to the psalms.[5] And Chrysostom, in his *Commentary on Psalm 150*, said that the cithara and lyre 'were then tolerated because of their weakness, and because they stirred them up to love and harmony . . . and because by such inducements they were led to a high pitch of zeal.' [6] Thus, certain instruments were used even in the early days of Christianity as an accompaniment for the voices in the singing of psalms and hymns. This practice died out in the Eastern Church, where to this day church-music is unaccompanied by instruments of any form.[7] The organ in particular was used in Byzantium only for purely secular purposes.[8] The practice of using the organ as a part of church-music pertained exclusively to the Western Church.

[1] J. W. Thompson, *An Economic and Social History of the Middle Ages* (New York: The Century Company, 1928), p. 69.

[2] Peter Wagner, *Introduction to the Gregorian Melodies* (2d ed., transl. Agnes Orme and E. G. P. Wyatt, London: Plainsong and Mediaeval Music Society (1901) p. 7).

[3] *Confessions*, x, 35.

[4] Theodoret, *Compendium Haereticarum Fabularum*, iv, 7 (*Patr. Graec.*, LXXXIII, 426). See also iv, 11.

[5] *Commentary on Psalm 91* in *Patr. Graec.*, XXIII, 1170 A.

[6] *Patr. Lat.*, LV, 497.

[7] Papadopoulos, *op. cit.*, pp. 2, 3, 10, 11. There seems to be evidence that in the early church, because of certain apostolic precepts, baptism was refused any one who played either the cithara or the lyre (*ibid.*, 11).

[8] Thanks to careful editing, there has been preserved on the manuscript of Julian the Apostate's epigram (see p. 391 above) a most intriguing note which states that the poem was composed during a procession when the young author was leaving the Church of the Holy

We know that in the West the organ eventually became the supreme liturgical instrument, but that prior to the fourth century only the cithara and the lyre were permitted, since their use was supposed not to turn the mind from sacred thoughts. Thus at some period the organ must have been introduced, and the evidence seems to indicate that that period was the eleventh century.

From the sixth century on, there is much evidence to show that the organ was used on ecclesiastical occasions when a chorus of voices formed part of the service. Thus we have it as an accompanying instrument for voices during processions of all types: on feast days,[1] on funeral occasions,[2] as a part of a grand ceremonial, or in a processional to a mass. We are fortunate in possessing graphic descriptions of the latter two examples.

The first is found in the *Vita Landeberti Episcopi Traiectensis Vetustissima*, on the occasion of the interment of a saint.[3] After Bishop Cugubert, accompanied by priests, deacons, and other members of the clergy, had clothed the body in rich vestments and sealed it in a sepulchre, 'then finally, all the people left the town on their knees, the chorus of psalms accompanied by a great crashing of cymbals and by the organ, which gave out a song of most agreeable modulations.'

There are several examples of the use made of the organ in the processional to the mass. One of the most striking is that of Fortunatus.[4] He describes the coming of dawn and the gathering of the men for the coming service. The turbulence of their coming gives

Apostles in Constantinople (see p. 306, n. 1, in the Loeb Classical Library edition). This evidently occurred when Julian was a lad in Constantinople and before his apostasy. It would be interesting could one assume that the epigram was suggested to the young man by the organ within the church just left. Unfortunately the note does not tell us that. And since the tendency of the Eastern Church is against such a use of the organ, I am afraid that we must pass by the reference as a tantalizing but inconclusive bit.

[1] *Vita Sollemnis Episcopi Carnoteni* (*Mon. Germ. Hist., SS. Rer. Mer.*, VII, 316); also *Vita S. Oswaldi Archiepiscopi Eboracensis*, xxvii, 66 (Jean Mabillon, *AA SS*, VII, *saec.* v, p. 734: 'et diebus festis sollium spiramento fortiore pulsati, praedulcem melodiam et clangorem longius resonantem ediderunt'). See also *Cauensis coenibii dedicatio* in *AA SS Boll.*, 4 Mar., VII, 34, 6, and St Bruno, *Carthusianorum Institutor*, pt. 1: Commentary on Psalm 150 (*Patr. Lat.*, CLII, 1420;).

[2] *Vita Desiderii Episcopi Viennensis* (*Mon. Germ. Hist., SS. Rer. Mer.*, III, 644).

[3] *Mon. Germ. Hist., SS. Rer Mer.*, VII, 379 ff.

[4] *Carmina*, ii, no. 9 (*Mon. Germ. Hist., AA.*, XI, 39).

way to an ordered chorus. Step by step the procession moves, the song swelling as it advances. Now the strings of the psalterium join their song to that raised by human voices. The tinkle of cymbals, the dry roll of tympana add color to the music. And then the pipe organ blares forth its ocean of sound from its large pipes, and the words of the song, repeated again and again by the men's voices, follow the melody of the instrument.

The *De Ecclesiasticis Officiis* of Amalarius, presbyter of Metz, gives a similar picture. According to his statement, the congregation was gathered in the church, the men standing on the southern side, the women, veiled,[1] on the northern.[2] Into the half-gloom of the church moved the procession of the clergy, bishop, deacons, subdeacons, acolytes, magnificent in white, scarlet, and gold, preceded by lighted candles and swinging censers. As they came, the majestic words of the Psalmist rang out: 'Praise ye the Lord. . . . Praise him with the sound of the trumpet: praise him with the psaltery and harp . . . praise him with stringed instruments and organs.[3] Praise him upon the loud cymbals. . . . Praise ye the Lord.' And as they sang, cymbals, trumpets, psalterium, organ rang out. Slowly, with great dignity, the procession moved down the left side of the church, and on reaching the altar, the bishop began the mass.

Furthermore, there is reason to believe that the organ accompanied the singing of hymns,[4] and especially the psalms.[5]

[1] iii, 2 (*Patr. Lat.*, cv, 1104 D).

[2] *Ibid.*, 1105 A.

[3] The presence of the word 'organs' in Psalm CL should not confuse the reader. The original term was 'ugab' (עוגב: *Sacred Book of the Old Testament* (ed. J. Wellhausen, Leipzig, 1895), which has been generally translated as 'pipes.' In the Greek Testament translated from the Septuagint, the term used is ὀργάνῳ, with the usual meaning of 'instruments' (H. B. Swete, ed., *Old Testament in Greek*, II (Cambridge, 1922), 414), which Jerome translated 'organo' (*Biblia Sacra secundum vulgatam Clementinam* (ed. P. M. Hetzenauer, Ratisbon, 1922), II. The English rendition 'organs' has, therefore, an archaic significance, and should be read 'pipes' or 'instruments'; see *NED.*, s. v. 'organ,' sb,[2] 2b.

[4] *Versus in Canticis Canticorum de Deo Sanctaeque Ecclesiae*, no. 31, stanza 17 (*Mon. Germ. Hist., Poet. Lat.*, IV, ii, 624); *Appendix ad Ermoldum: versus ad Pueros* (*ibid.*, II, 92–93); Bede, *Interpretatio Psalterii* (*Patr. Lat.*, XCIII, 1101 B).

[5] Sedulius Scottus, *Carmina*, ii, no. 63 (*Mon. Germ. Hist., PP.*, III, 219); *Bibliothecarum et Psalterium Versus VI ad Karolum Caluum* (*ibid.*, 262); Radbotus, *Carmina*, iv (*ibid.*, IV, 168, l. 82); *Codicis Bernensis CCCLVIII Sylloga:* 'De Musica,' (*ibid.*, 255, l. 47). See also p. 403, n. 5, above.

Whether the organ was used in the mass proper,[1] however, is another question. There seems reason to believe that such was not the case prior to the twelfth century. Indeed, there is positive evidence to the contrary. Take, for example, the *De Ecclesiasticis Officiis* and the *Eclogae de Officio Missae* [2] of Amalarius, presbyter of Metz. These two works contain an exact description of the mass as it was said at Metz and at the court of Louis the Pious, at whose command, indeed, the two works were written. They are of no little significance, for at Metz was probably found the Gregorian tradition in its purest form in the ninth century. We know that Gregory the Great is reputed to have founded a *Schola Cantorum* at Rome in which singers were trained and sent into Gaul, Germany,[3] and England.[4] More specifically, we know that Pepin and Charlemagne imported from this school singing-masters at various times.[5] In 787 Charlemagne brought into Gaul two singing-masters, of whom one, Theodore, went to Metz, the other going to Soissons.[6] The inability of the Franks to sing disgusted the two Italians, but through the expenditure of much effort the standards of Metz were raised to such a point that they were considered the highest in Gaul.[7] These same Romans seem to have brought organs with them.[8] Now, Amalarius wrote his two works about 825 A.D. The ordinary of the mass prescribed by him probably represented the Gregorian tradition in the purest form then available. He stated categorically that the

[1] Although the organ seems to have been used as an accompaniment for hymns and psalms, and although these two musical forms may have been part of the mass, the fact that the organ was so used is in itself no guarantee that the organ was used as an accompaniment to voices during the mass, since both hymns and psalms were used in non-liturgical services.

[2] *Patr. Lat.*, CV, 1315–33.

[3] John the Deacon, *S. Gregorii Magni Vita*, ii, 7 (*Patr. Lat.*, LXXV, 91); *Codex Carolinus*, no. 41 (*Mon. Germ. Hist., Epistolae*, III, 553–554).

[4] Bede, *Historia Ecclesiastica*, ii, 20 (ed. C. Plummer (Oxford, 1896), I, 126), and iv, 16 [18] (pp. 240–242).

[5] Pope Paul I wrote to Pepin regarding monks sent to Rome and Rouen to learn how to sing psalms in the Roman fashion (*Codex Carolinus*, no. 41, cited in note 3 above).

[6] *Annales Laurissenses*, anno 787 (*Mon. Germ. Hist., SS.*, I, 170, l. 58); John the Deacon, *op. cit.*, c. 8 and 9 (p. 91); Ekkehard IV, *Casus S. Galli*, c. 3 (*Mon. Germ. Hist., SS.*, I, 102).

[7] *Annales Laurissenses*, anno 787, *loc. cit.*, p. 171, l. 40. See also the Monk of St Gall, *De Carolo Magno*, i, 10 (P. Jaffé, *Bib. Rer.*, IV, p. 641).

[8] Monk of St Gall, *De Ecclesiastica Cura Caroli Magni*, i, 20 (André Duchesne, *Historiae Francorum Scriptores* (Paris, 1636–1649).

singers at Metz — and consequently at the court of Louis the Pious — used no instruments to accompany their chanting.[1] There is similar evidence for monastic foundations, although the *Regulae* of the period made no specific provision against the use of the instrument. Thus, the monks of Fulda, who followed the *Benedictine Rule*,[2] did not use the organ at all in their services.[3] The monks of Casale were definitely prohibited from either learning or teaching the organ.[4] The commentator in the Migne edition of the *Rule* also indicated that the ancient customs of Monte Cassino forbade the construction of organs without the permission of the head of the chapter.[5]

Consequently, it seems probable that although the organ was well established in Gaul as an accompanying instrument for chants used when a great number of voices were singing, as in processions, and in the singing of psalms and hymns, it was not used as such in the service of the mass from the eighth to the eleventh centuries. It seems to have been used to indicate to the choir the pitch on which to begin a chant.[6] Amalarius says that at Metz the trumpet was so used.[7] But when the organ was present in the church, I have no hesitation in attributing this function to it. It will be remembered that such was the practice in Byzantium, where the organ had a specific part to play in great civil festivals.[8]

Were it not for the fact that the organ was not used as an accompanying instrument on civil occasions in Byzantium, there might be reason to suspect a liturgical rule prohibiting its use in the western mass, since it was used on non-liturgical occasions and not in the mass. In view of the Byzantine custom, however, we must turn elsewhere for an example of its omission.

[1] 'Our singers hold neither cymbals nor lyres nor cithara in their hands, nor any other kind of musical instrument' (*De Ecclesiastica Officiis*, iii, 3, p. 1106 D).

[2] *Vita S. Sturmi*, c. 14 (*Mon. Germ. Hist.*, II, 371).

[3] S. Pater Benedictus, *Regula Commentata*, c. 19 (*Patr. Lat.*, LXVI, 476 A).

[4] *Ibid.* (p. 475 D).

[5] *Ibid.*

[6] *Vita Caesarii Episcopi Arelatensis* in *Mon. Germ. Hist.*, *SS. Rer. Mer.*, III, 496.

[7] *Liber de ordine antiphonarii*, 1 (*Patr. Lat.*, CV, 1247).

[8] See pp. 18–20 above. Papadopoulos makes the interesting suggestion that the organ was used while practicing although not at the performance itself (*op. cit.*, pp. 11, 12).

When one considers the many references to the thunderous quality of the early organ music,[1] and to the use made of it when the voices singing were many in number,[2] one is led to suspect that while the tremendous emotional quality of the organ tone was recognized at an early date, the main reason for its exclusion from the music of the mass was that it was unfitted to accompany either a single voice or a small number of voices.[3] This may have been because of its great size. Large organs continued to be built throughout the early period, if we may judge from the classic example of the great Winchester organ, built in the tenth century. It is reported that this instrument required seventy men to keep up a proper air pressure, and that the volume of sound given out by it was terrifying to hear.[4] Indeed, as late as the twelfth century, Aelred, Abbot of Rievaux, protested that the organ was no fit instrument for use in the church service because of the terrific noise it made.[5] But the reason may also have been that it was too awkward mechanically to permit its use. When the mechanism of the organ was improved sufficiently so that it could be used to accompany voices in small numbers, it seems to have been introduced into the mass. Thus we find Honorius of Autun referring to it as part of the service in the first half of the twelfth century,[6] and justifying its use by scriptural citation.[7] Balderic, archbishop of Dol in the twelfth century, indicated its use, and defended the instrument against those who complained of the noise it made by saying that if it thumped and wheezed, the fault was as much lack of care as the nature of the instrument itself.[8] Reiner of St Laurent [9]

[1] Thus the descriptions of Julian the Apostate (p. 391 above); Jerome (p. 398 above); Optatian (p. 395 above); Ammianus Marcellinus (p. 398 above); Sidonius Apollinaris (p. 390, n. 6 above); Fortunatus (p. 404 above); Bede (p. 396 above); Ikhwân al-Safâ (p. 398 above). See also Aldhelm's riddle on the organ (p. 390, n. 2 above), and Wolstan, *Prologue* to *Vita S. Swithuni* (Jean Mabillon, *AA SS*, VII, 5 *saec.*, p. 617). [2] See pp. 404–405 above.

[3] It is perhaps not insignificant that to this day the term used to designate unaccompanied vocal music is '*a capella*.'

[4] Wolstan, *op. cit.*, p. 31, n. 3. For other examples of the building of large organs, see p. 14 above.

[5] *Speculum Charitatis*, ii, 23 (*Patr. Lat.*, CXCV, 571).

[6] 'Then they sang the sequence with voice and organ' (*Gemmae animae*, c. 77, in *Patr. Lat.*, CLXXVII, 567 D). [7] *Ibid.*, c. 139 (*ibid.*, 587 D).

[8] *Epistola ad Fiscamneses*, c. 7 (*Patr. Lat.*, CLXVI, 1177).

[9] *De Claris Scriptoribus Monasterii Sui*, ii, 7 (*Patr. Lat.*, CCIV, 31).

and William of Malmesbury [1] testified to the sweetness of its tone. And in the thirteenth century, Johannes Aegidius said that the organ alone was used in the music of the mass.[2]

This change in attitude toward the organ is not surprising if one remembers the changes in construction which took place in the eleventh century. At that time it was known that different finishes on the pipes would produce differing qualities of tone,[3] and that the delicacy of the sound emitted would be in proportion to the size of the opening in the pipe itself.[4] But in addition to these improvements in the quality of the organ tone, noticeable in the eleventh century, the first step toward an improvement in the action of the keys since the first century A.D. was made at that time. The spring-box mechanism was introduced in the last quarter of the eleventh century,[5] the slider-box keyboard gradually disappeared, and the modern keyboard, with black and white keys, slowly came into being. This was the first great change in organ construction since the time of Vitruvius, a thousand years before. Instead of pushing and pulling tones out of the great organ, they were pressed out, in the same way that they are to-day. The corresponding ease of execution is too obvious to require emphasis. With such changes in the construction of the instrument, changes which not only altered the quality of its tone but also increased the ease with which it could be played, the gradual use of the organ as an accompanying instrument in the mass seems to be explained. Its previous exclusion was based on practical rather than on liturgical grounds. When it no longer drowned out the voices, the inspiration roused by its tones was freely recognized and made use of.

As might be expected, the changes evolved were not sudden or precipitate. By the tenth century a new interest in the organ and organ construction was being evinced, and in the monasteries. The first treatises on organ construction written since the time of Vitruvius were written by Odo, the great abbot of Cluny,[6] by Notker

[1] *Gesta Pontificum Anglorum* (Rolls Series, No. 52, p. 429).

[2] 'in proses, and in sequences and hymns' (Martin Gerbert, *Scriptores, cit. supra*, II, 388).

[3] See p. 400, n. 5 above.

[4] *Ibid.*

[5] Such was the construction of the Magdeburg organ, apparently erected about this time. Audsley quotes Seidel on this point (*op. cit.*, p. 28).

[6] M. Gerbert, *Scriptores*, I, 303.

Balbulus,[1] by Hucbald,[2] by Bernelin[3] — all of them monks. Dunstan in England not only was noted as a performer on the organ, but also furnished many churches and monasteries with instruments.[4] Ethelwold, abbot of Abingdon and later bishop of Winchester, constructed an organ with his own hands.[5] Gerbert (Pope Sylvester II) was also noted as a builder of organs,[6] being reputed among other things to have constructed an organ operated by steam.[7] When pope, Gerbert established a studio of organ construction at Rome where was practised the art which he seems to have learned when a monk at Bobbio. When his former professor, Gerhard, abbot of Aurillace, wrote requesting an organ of him, he replied regretfully that the unsettled conditions in Italy would not permit the fulfilment of the request.[8] The matter seems to have bothered him somewhat; for in 987, the year of Gerhard's death, he wrote to Raymond, Gerhard's successor, saying that the organ was on the way, but that he could say nothing as to the whereabouts either of the organ or of the monk sent in charge of it.[9] And finally, it is recorded that Earl Elwin presented an organ to the convent of Ramsay on which he spent thirty pounds in copper pipes.[10]

Thus, the interest in the organ, evident from the time of Notker Balbulus in the late ninth and early tenth centuries, bore fruit in the improvements of the eleventh. And in the following century the organ as a liturgical instrument came into its own, to replace, by the thirteenth century, all other instruments formerly used in the mass.

[1] d. 912 (M. Gerbert, I, 107). [2] *Ibid.*, 147–148. [3] *Ibid.*, 329.

[4] William of Malmesbury, *Vita Sancti Dunstani*, i, 4 (Rolls Series, No. 63, p. 257) and *Gesta Pontificium Anglorum* (Rolls Series, No. 52, p. 407). Dunstan was not the first to introduce organs into England as has so often been claimed. See *Vita Wilfridi I Episcopi Eboracensis Auctore Stephano* (*Mon. Germ. Hist., SS. Rer. Mer.*, VI, 201).

[5] *Historia Monasterii de Abingdon*, ii (Rolls Series, No. 2, p. 278).

[6] *Epistolae*, nos. 70, 91, 92, 163, in Julien Havet, *Collection de Textes pour servir à l'Etude et à l'Enseignement de l'Histoire* (Paris, 1889), vol. VI.

[7] William of Malmesbury, *Gesta Regum Anglorum*, ii, 168 (*Patr. Lat.*, CLXXIX, 1140).

[8] *Epistolae*, no. 70, p. 67. [9] *Ibid.*, no. 91, p. 83.

[10] *Vita S. Oswaldi Archiepiscopi Eboracensis*, xxvii, 66 (Jean Mabillon, *AA SS*, VII, 5 *saec.*, 734).

COLUMBUS, OHIO

THE UNIVERSITY OF CHICAGO PRESS JOURNALS

The Medieval Academy of America

Early History of the Organ

Author(s): Willi Apel

Source: *Speculum*, Apr., 1948, Vol. 23, No. 2 (Apr., 1948), pp. 191-216

Published by: The University of Chicago Press on behalf of the Medieval Academy of America

Stable URL: http://www.jstor.com/stable/2852952

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EARLY HISTORY OF THE ORGAN

By WILLI APEL

For many years I have been engaged in research and preparatory work for a book on the history of keyboard music. Being chiefly interested in the music itself, I had hoped that I would find no difficulty in writing a short initial chapter about the keyboard instruments on the basis of information available in other books and articles. While this hope turned out to be justified in the case of the harpsichord, the clavichord, and the pianoforte, it proved delusive when I turned to the early history of the organ. Although the literature on this subject is considerable in quantity, it is full of misinterpretations, misquotations, half-truths, and errors. I was particularly disappointed by an article to which I had looked forward with great expectations — H. R. Bittermann's 'The Organ in the Early Middle Ages,' published in Speculum, iv (1929), 390–410. Although this article is useful for its references to sources, the text is full of unfounded and misleading statements. For instance, we are told (p. 391) that in the earliest type of organ 'the method of playing was to close all the pipes but the one to be sounded by the palms of the hand.' Even if the player had arms like Vishnu, he would find this a difficult task. On p. 392 appears the statement that 'an organ pipe will rise in pitch from one to two octaves (*sic*), be the pressure increased ever so slightly.' On p. 391 we read that 'the first instrument was nothing more than an inverted vase, open at the top, to which a trumpet was attached.'[1] We hear the long discredited story, probably copied from C. F. Abdy Williams, *The Story of the Organ* (London, 1903), that this 'first instrument' was invented by Ctesibius, that this Ctesibius was a barber,[2] and that Hero of Alexandria was the inventor of the hydraulis. Bittermann also 'imagines' (p. 400) that the organs from the fourth to the eleventh centuries were 'capable of great crescendos and of delicate diminuendos.' Many of her philological errors have been corrected in an article by M. L. W. Laistner, in Speculum, v (1930), 217 ff. Others will be mentioned in the course of the present study.

I know of only two good, scholarly studies of the early history of the organ — both little noticed in English writings — namely, H. Degering, *Die Orgel, ihre Erfindung und ihre Geschichte bis zur Karolingerzeit* (Münster, 1905), and E.

[1] Very likely this story has its origin in one of the many fancy inventions described in Hero's *Pneumatica*, possibly in No. 49: 'A Trumpet, in the Hand of an Automaton, Sounded by Compressed Air' (*The Pneumatics of Hero of Alexandria*, transl. by B. Woodcroft, [London, 1851], p. 49).

[2] The confusion between a barber Ctesibius and the famous engineer of the same name goes back to a passage in Athenaeus' *Deipnosophistae*, iv, 174e. See H. Degering, *Die Orgel, ihre Erfindung und ihre Geschichte bis zur Karolingerzeit* (Münster, 1905), pp. 6 ff. and 41 ff.; also the detailed discussion in Pauly-Wissowa, *Encyclopedie des klassischen Altertums*, *s.v.* 'Hydraulis.' Vitruvius (*De Architectura*, ix, 8) tells us that the father of Ctesibius was a barber, and this statement offers a plausible explanation for Athenaeus' mistake. Vitruvius also says that Ctesibius, experimenting with mirrors in his father's shop, discovered that compressed air, if driven forcefully out of a tube, produces a musical sound. This, of course, was known long before the time of Ctesibius, and Vitruvius' report, if it can be trusted at all, would seem to be on a level with that about Newton's apple.

Buhle, *Die Blasinstrumente in den Miniaturen des frühen Mittelalters* (Leipzig, 1903), pp. 52–116. In the present study I shall try to give a proper evaluation of the source material made available by Degering, Buhle, Bittermann, and others.

I

The organ, by far the oldest of all keyboard instruments, goes back to Greek antiquity. The three essential traits of its construction are a set of pipes each having its own pitch, artificial wind supply, and keys by which the wind is admitted and stopped. Nearly all sources name Ctesibius, a Greek engineer who worked in Alexandria in the third century B.C., as the one who — no doubt, on the basis of earlier attempts — succeeded in constructing the first organ, the so-called 'hydraulis.'[3] Alexandria at that time was the world's center of scientific and engineering activity, and the hydraulis was one of the many achievements which spread the fame of this city. Pliny, in his *Natural History* (*ca* 50 A.D.), mentions the invention of the hydraulis together with the achievements of Archimedes, with Chersiphron's temple of the Ephesian Diana, with Philo's dockyards for 400 ships at Athens, and with Dinochares' plan for the founding of Alexandria.[4]

The hydraulis has been described in detail by Hero, in his *Pneumatica* (*ca* third century B.C.). and by Vitruvius, in his *De Architectura* (*ca* 14 B.C.).[5] In addition there exists a number of pictorial representations, gems, mosaics, and reliefs. Of particular importance was the discovery, in 1885, of a well preserved clay model in the ruins of Carthage, and in 1931, of portions of an actual instrument in Aquincum near Budapest.[6] From all this evidence we can form a very clear picture of the hydraulis, and this is all the more important since to the present day the principles of its construction, though extremely simple, are not generally understood.[7] They are briefly explained here just as set forth by Hero.

[3] Only Tertullian ascribes the invention to Archimedes. See p. 198.

[4] *Nat. Hist.*, VII, 125.

[5] *Pneumatica*, I, 42; *De Architectura*, X, 8. Both texts are reprinted and translated in Charles Maclean's excellent study, 'The Principle of the Hydraulic Organ' in *Sammelbände der Internationalen Musikgesellschaft*, VI (1904/5), 183–236.

[6] Practically all the extant representations are reproduced in Degering. For a description and photographic reproduction of the Aquincum organ, mainly fragments of pipes and a bronze tablet with an inscription of 228 A.D., see V. Kuzsinszky, *Aquincum* (Budapest, 1934). A reconstruction, not too convincing in its details, was shown at an exhibition in Rome in 1937; see *Mostra Augustea della Romanità, Catalogo* (Rome, 1938), I, 834 and pl. CXLIII; vol. II, 384.

[7] One of the most recent and most widely read reference books on music, P. A. Scholes' *The Oxford Companion of Music* (London, 1938), *s.v.* 'Hydraulus,' says that 'the blowing apparatus of the hydraulus was not unlike that of today,' and that 'there seems to have been one variety in which air was forced into the pipes by the flow of water." Actually, the blowing apparatus, more than anything else, distinguishes the hydraulis from the later organs up to the present day. The second statement is so vague that is is impossible to say what the author had in mind (if anything definite at all), particularly since no information about other varieties is given. It comes dangerously close to those old stories according to which water 'flowed through the pipes' of the hydraulis. In the same article we read that some of the old organs had 'as many as ten ranks of pipes,' that their tone was 'enormously powerful' and carried 'for sixty miles,' so that 'the players were compelled to plug their ears to avoid damage to them.' The last two statements are taken over from the Arabic 'Muristus treatise' (described in

The wind mechanism of the hydraulis consists of two main parts, an air pump and a diving bell. The air pump, as described by Hero, is essentially the same as in present-day models. A piston moves up and down in a metal cylinder which is open at the bottom but closed at the top, except for two openings, A and B, both of which serve as valves. A, the intake valve, consists of a light round metal plate (*platysmation*) which is held in place by three or four pins and which easily moves up when the pressure increases, thus closing the opening. The compressed air is forced out through the opening B into the pipe leading to the diving bell. A movable keg valve inside the pipe (not mentioned by Hero, but described by Vitruvius) keeps the air from flowing back. The diving bell (*pnigeus*) consists of a large metal bell which is placed inside an open container filled with water. The bell rests on a number of metal blocks so that there is free flow of water around its bottom. The bell does not move up and down (as in the diving bell proper), but is held stationary, either by its own weight or by some special arrangement. A vertical pipe leads from the top of the bell to the wind chest, on top of which are placed the pipes. The purpose of the bell is to change the pulsating pressure generated in the pump into a static pressure which is required to make the pipes sound even. All that is necessary to insure even pressure in the bell and in the wind chest is to keep forcing enough air into the bell so that bubbles constantly escape from the bottom and rise to the surface. Another advantage of this apparatus, truly ingenious in its simplicity, is that the amount of pressure in the wind chest can easily be modified by changing the height of water in the container.

The bubbles which constantly appeared on the surface of the water when the hydraulis was in operation may have been the reason for the fantastic notion that the water was hot or boiling. The very fact that the earliest reference to this occurs in a rather late source, the twelfth-century *Gesta Regum Anglorum* of William of Malmesbury,[8] should make one suspicious; but several writers have seriously admitted the possibility that the hydraulis, perhaps in a later stage of its evolution, was a steam 'organ,' a forerunner of the calliope.

Fig. 1 (which, no doubt, is copied from a much earlier manuscript) and Fig. 2 serve to illustrate the description given above. ρ, σ is the air pump; ϵ, ξ, η, ϑ the diving-bell; ω the intake-valve (*platysmation*).

Fig. 1 also includes a drawing of the key mechanism of the hydraulis, according to the detailed explanations of Hero, which we shall now consider (Fig. 3). Under each pipe is a box with a horizontally moving slide S. The slide has a hole which

H. G. Farmer's *The Organ of the Ancients from Eastern Sources* [London, 1931], pp. 128 ff.), a report of highly questionable authenticity. Farmer's far-reaching conclusions regarding the origin of the organ, hydraulic as well as pneumatic, are not incorporated in the present study, because I feel they are far from convincing. I do not see any evidence that Muristus was an ancient (*sic*) Greek author (Farmer identifies him with Ctesibius) or that the instrument assigned to him was a hydraulis. I get the impression that it was a signaling instrument of the eighth or ninth century consisting of a single pipe which by means of bellows and a hydraulic pressure stabilizer could be made to produce a very loud sound.

[8] II, 168 (*Patr. Lat.*, CLXXIX, 1140): 'per aquae calefactae violentiam.' Farmer, *op. cit.*, p. 156, suggests that *calefactus* means only 'disturbed.'

lies under the pipe whenever the slide is pushed in. The slide is connected with a lever mechanism consisting of three jointed bars, DC, CB, and BA, and moving around a pin at P. (To make this mechanism do the required job, there have to

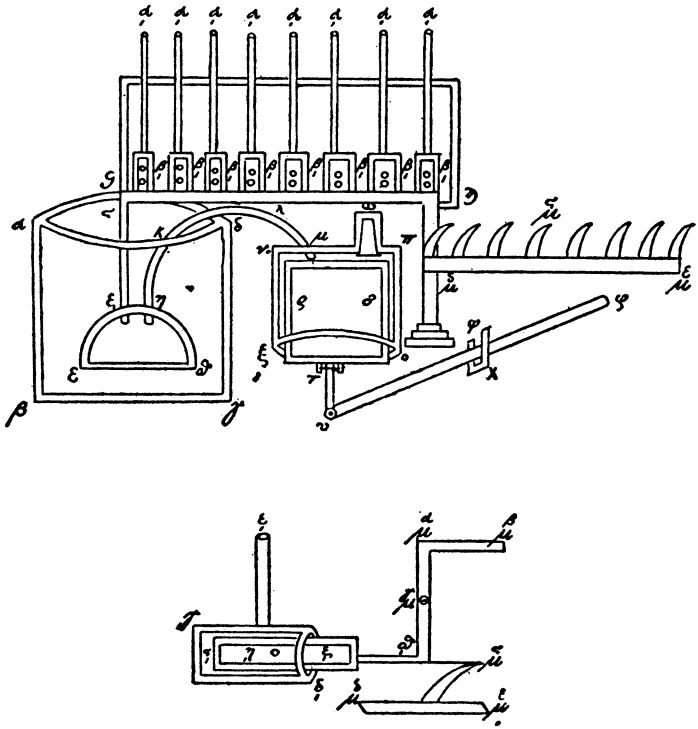


FIG. 1. *Harleiananus 5589*, s. XVI. W. Schmidt, *Heronis Alexandrini Opera . . .* (Leipzig, 1899), I, Supplementum, p. 10.

be movable joints at D and C, but a rigid connection at B.) It appears that upon depressing the 'key' at A, the slide will be pushed in so that the hole coincides with the opening of the pipe, thus admitting air pressure into the pipe. Finally, provision is made for a spring mechanism which will automatically return the slide into its normal position when the finger is withdrawn This consists of a curved and elastic slip of horn, H, the lower end of which is fastened to a fixed rod, RR, while its upper end is connected with the bar BC by means of a taut string, HT. If the key is depressed, the string pulls the horn into a straighter shape, and the elastic force of the horn draws the whole mechanism back into its normal position, the moment the key is released.

Vitruvius describes much the same construction as does Hero, although not with the same grasp and clarity. He omits the description of the keyboard,[9] but

[9] This does not mean, as has been implied, that his organ had no keyboard. An organ with more than two or three pipes and without a keyboard of some sort is an impossibility.

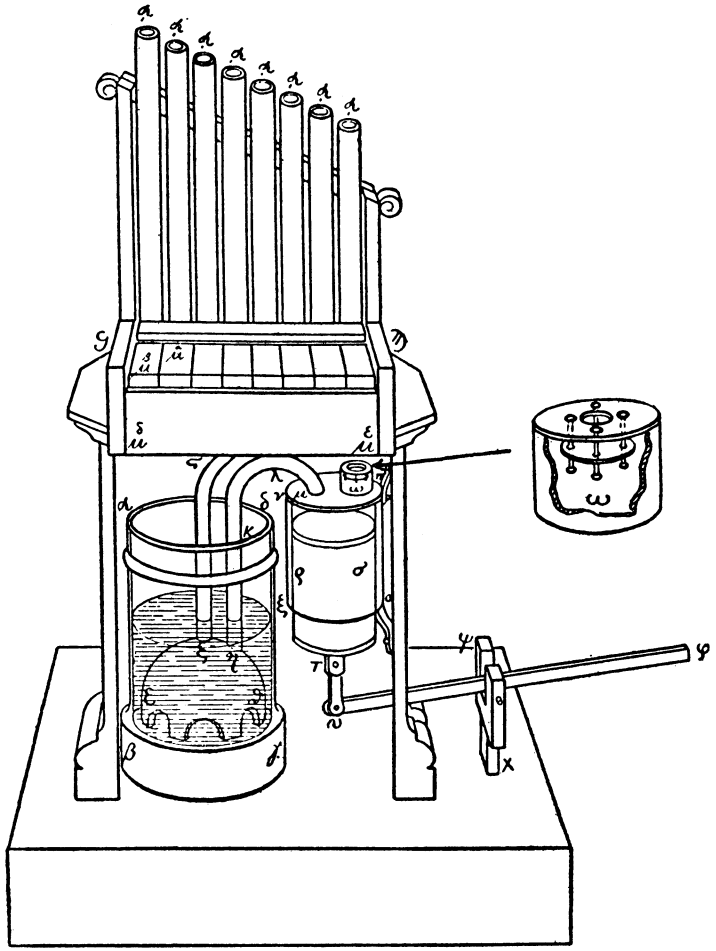


FIG. 2. Modern Drawing. W. Schmidt, *op. cit.*, vol. I, p. 194.

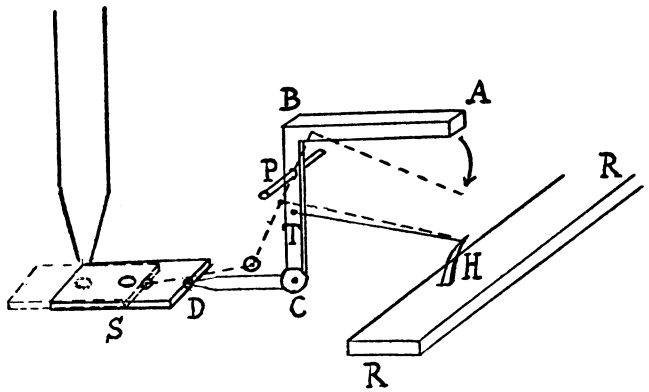


FIG. 3. Key Mechanism of the Hydraulis.

adds certain technical improvements, the most important of which is that two air pumps are used instead of one, an arrangement which was generally accepted, if we may judge from extant representations of the hydraulis. He describes the pump valves as *delphini* holding in their mouths a chain from which a small inverted basin is suspended. Evidently these *delphini* moved around an axis and served to counteract the weight of the basin, so that a minimum of air pressure was sufficient to push the basin upwards and to close the valve — no doubt, an improvement over Hero's *platysmation*. Fig. 4 shows what Vitruvius' *delphini*

FIG. 4. Vitruvius' Delphini. Isaac Vossius, *De Poematum Cantu et Viribus Rhythmi* (Oxford, 1673), p. 98. Maclean, *op. cit.*, p. 224.

may have looked like, except that here the chain is fastened to the tail. Unfortunately, these *delphini* became another subject of fantastic speculation, all the more because of their legendary connection with Orpheus.[10]

Turning from speculation to reality, we should now consider actual representations of the hydraulis. Among those shown on the plate reproduced from Degering, *Figur 5*, from a Roman gem, is particularly clear and true to life. By far the clearest insight is obtained from the previously mentioned (p. 192) clay model of Carthage (Figs. 5 and 6). Various details can be distinguished: three ranks of pipes, each containing eighteen pipes of varying length but all of the same diameter; two lateral metal containers serving as air pumps; above these the shoulder pieces of the pump handles; a large central container which held the water and the bell; and between the two side pumps the legs of the organist, who apparently stood on a high pedestal. To judge from the size of the legs, the size of the instrument was about four yards in height and two yards in width.

The hydraulis is usually thought of as having had a loud and noisy sound, but a careful examination of the sources shows this opinion to be without foundation. Statements to the contrary, however, are not lacking. Cicero, who describes its use at banquets, calls its sound a sensation as delectable to the ears as is the most delicious fish to the palate.[11] Particularly interesting is the following passsage from Athenaeus' *Deipnosophistae*, a book which was written in Rome about 220 A.D. and which contains a wealth of information about all aspects of Roman life and culture: 'While many remarks of this nature were still being made, there was heard from a neighbouring house the sound of a water-organ (*hydraulis*); it

[10] I remember having seen, many years ago, a seventeenth-century illustration of the hydraulis which looked like an aquarium with two swimming dolphins held in place by an elaborate system of chains.

[11] *Tusc. Disp.*, III, 43.

was very sweet and joyous, so that we all turned our attention to it, charmed by its tunefulness. And Ulpian, with a glance at the musician Alceides, said: "Do you hear, maestro, that beautiful harmony (*symphonia*) which has lured us all, completely beguiled by its music? It is not like the 'single-pipe' (*monaulos*) so common among you Alexandrians, which causes pain to the listeners rather than

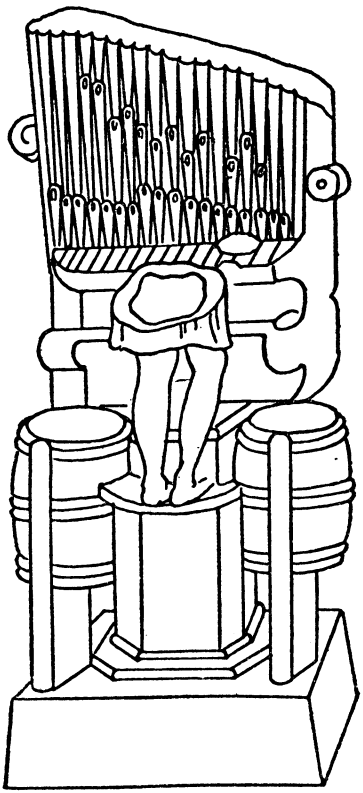


FIG. 6. Clay Model of Carthage, rear. W. Schmidt, *op. cit.*, I, p. XLII.

any musical delight." '[12] Evidently, the instrument described here had a soft and pleasant sound, and very likely was of small size, suitable for domestic use.

On the other hand, the hydraulis probably was also used to accompany gladiator fights and circus performances, and such instruments had to be larger in size and more powerful in sound, although not necessarily 'noisy' and 'thundering.' The word 'probably' is expressly used in order to counteract the universal tendency to play up this aspect to such an extent as to make it appear the most important fact about the hydraulis. Actually, the documentary evidence for this use is rather slim. Only one writer mentions it, namely, Petronius (died *ca* 66 A.D.) in *Satyrikon*, XXXVI, 6, where, upon Trimalchio's command, 'the meatcutter

[12] Athenaeus, *Deip.*, IV, 174a–b (tr. C. B. Gulick, Loeb).

proceeds and, to the sound of music, cuts the viands with such gesticulations that you might think a gladiator was fighting under the sound of a hydraulis' (*ut putares essedarium hydraule cantante pugnare.*) In addition to this remark, a number of representations on contorniates and vases are cited as evidence (for instance, Figures 1, 2, 3 of the Degering plate), but not all of these are convincing.

Nero (37–68 A.D.) was one of several Roman emperors who played the hydraulis. Of particular interest is a report[13] according to which, on a day of political danger (insurrection of the Gauls under Vindex), he summons some of his first advisers to his home, but after a short consultation spends the greater part of the day showing them a new type of hydraulis (*organa hydraulica novi et ignoti generis*), pointing out and explaining the details of its construction, adding jokingly that he would like to have the instrument transferred to the theatre, 'if Vindex permits.'

Aside from its manifold practical uses, the hydraulis exercised considerable attraction upon the imagination of poets and writers. In the poem *Aetna* (perhaps written in the time of Augustus), the hydraulis serves as a simile for the volcanic powers which produce a great noise through compressed air: 'And as in spacious theatres the melodious organ (*cortina*, i.e., vessel, perhaps with reference to the *pnigeus*) sounds its whirling song with varied tunes (or tones? pipes? *imparibus modis*) through the art of the player which stirs the water like an oarsman (*subremigat unda*) and drives in the thin [stream of] air — just so . . . '[14]

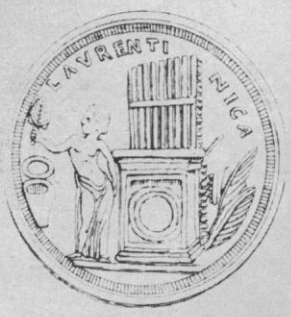
The early church father Tertullian (*ca* 160–230 A.D.), in his *De Anima*, uses the hydraulis as a symbol of an organism consisting of many parts: 'Behold the marvelous art of Archimedes, I speak of the hydraulic organ: so many members, so many joints, so many sound conduits, so many combinations of tones, so much interplay of tunes (*commercia modorum*), so many rows of pipes: and all forming one structure.'[15]

Publilius Opatatianus Porphyrius (*ca* 325 A.D.) wrote a poem of 26 lines, each of which has one letter more than the preceding one. Being placed perpendicularly on the page, they represent the 26 pipes of an organ. Another poem consisting of lines with an identical number of letters and placed beneath the other, represents the windchest (*carmen figuratum*). In the former poem we find a description of the hydraulis, the 'pipes whose length increases,' the 'keys (*quadrata plectra*) by which the hand of the player opens or closes the wind conduits,' the 'hidden water agitated by the onrushing air,' the 'concerted efforts of several youths' working at the pumps: 'at the least movement are the often excited keys opened

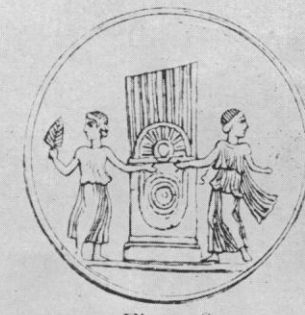
[13] Suetonius, *Nero*, 41. Suetonius' report contains nothing to indicate that Nero invented this new type of organ, as is often stated.

[14] *Aetna*, 295 ff. (ed. Robinson Ellis [Oxford, 1901], p. 39). A detailed study of the many grammatical problems and rhetorical subtleties of this poem, as well as of others to be quoted subsequently, is found in R. Hildebrandt, 'Rhetorische Hydraulik' (*Philologus*, LXV, 425 ff.). For substantial help in dealing with these poems, I am greatly indebted to Prof. Herbert Bloch of Harvard University.

[15] Ed. F. Oehler, ii, 576. G. A. Audsley, in *The Art of Organ Building* (1905), i, 12, erroneously translates the last sentence (*et una moles sunt omnia*): 'and all at one touch.'



Figur 1.



Figur 2.

Figur 6.

Figur 3.

Figur 5.

Figur 4.

Degering, *op. cit.*, Tafel VII. 1, 2, 3, 4: Coins; 5: Gem; 6: Mosaique of Nennig.

FIG. 5. Clay Model of Carthage.

or the pleasant sounds deadened, and everything is constrained by meter and rhythm.'[16]

Claudius Claudianus (*ca* 365–408 A.D.), in his *Panegyricus dictus Manlio Theodoro Consuli* of 399,[17] enumerates those who 'shall contribute to our delight': the clown, the mime, the flute player, the lyre player, the comedian, the tragedian and also 'he who, with a light touch (*levi tactu*) can elicit loud sounds (*magna murmura*), and can sound the innumerable voices of the brazen field (*segetis aeneae*) with a nimble finger (*erranti digito*), and through a beam-like lever rouses to song the labouring waters from the depth.'

Near the end of the fourth century, enthusiastic admiration of the hydraulis gave way to complaints about its excessive use. Ammianus Marcellinus (*ca* 330–395 A.D.) deplores the neglect of philosophical and other serious studies, saying that 'organa fabricantur hydraulica,' while the libraries remain closed.[18] Even in the fifth century the hydraulis was still so commonly used at banquets that Sidonius Apollinaris (*ca* 430–482) compliments Theoderic II for banishing it from his meals: 'No hydraulic organs are heard there . . . ; no lyre players, flute players, chorus leaders, or female players of drums and psalteries. The king is soothed only by those fiddles (*fidibus*) which appeal to the virtuousness of the mind no less than to the senses of the ear.'[19]

This is about the last authentic reference to the hydraulis we have.[20] In the meantime another type of organ had appeared in which the hydraulic mechanism was replaced by bellows: the pneumatic organ. Usually, an epigram of Julian the Apostate (331–363 A.D.) is regarded as the earliest evidence of this instrument, but there is a much earlier reference which deserves to be considered in

[16] *Carmina*, XXb, 14–26 (ed. Kluge [Leipzig, 1926], p. 26; cf. also No. IX of the appendix for a reproduction of the *carmen figuratum*). A correct translation of this highly artificial poem presents extraordinary difficulties, as appears from the lengthy considerations in Hildebrandt's article (cf. *supra*, note 14). Bittermann's rendition (p. 395) is extremely free. There is nothing in the original text which could be translated as 'rapid and vigorous songs,' 'calm and simple melody,' or 'can inspire a religious terror.'

[17] *Claudian*, transl. by M. Platnauer (Loeb), I, 36. Curt Sachs, in *The History of Musical Instruments* (New York, 1940), p. 144, quotes a passage from 'the Roman poet, Claudianus Mamertus,' which is strikingly similar to the one quoted above. I have been unable to find this passage in the works of Claudianus Mamertus, bishop of Vienna, or in those of the Roman poet Claudius Mamertinus. If the passage quoted by Sachs is that of Claudius Claudianus, its references to 'numberless slides' and 'powerful sound' are without foundation.

[18] XIV, 6, 18 (tr. J. C. Rolfe, Loeb).

[19] *Patr. Lat.*, LVIII, 449.

[20] To be sure, the word hydraulis occurs in many later sources, but in the general meaning of organ, without the special connotation of a water organ. The latter may have been lost as early as 400 A.D. as is suggested by the following passage in Augustine's *Enarrationes in Psalmos* (*Patr. Lat.*, XXXVII, 1964, 7): 'Now, since, as I have said, the Greek word *organum* is used for all musical instruments: therefore the Greeks have another name for that which is provided with bellows.' Very likely, that other name was hydraulis. At any rate, the fact that an instrument of the eighth or ninth century is called 'hydraulica' or 'organum hydraulicum' cannot be interpreted to indicate that it was a hydraulis. See also note 38.

this connection, a passage from Pollux' *Onomastikon* (*ca* 120 A.D.), which has been little noticed in English writings:[21]

Quite different is the Tyrrhenian aulos, not unlike a syrinx turned upside down, with brazen pipes, blown from below. The smaller one is blown by bellows, the larger by water which sends forth a breeze of air. This aulos is of many sounds (πολύφωνος), and the bronze has a rather vigorous voice.

In spite of the somewhat vague and unusual name, 'Tyrrhenian aulos,' there can hardly be any doubt that the instrument described is an organ, and that it existed in two varieties, the smaller of which had bellows. It is reasonable to assume that this pneumatic variety existed some time before the date of Pollux' writing; and it is not impossible to think, as Degering suggests (p. 52), that this was Nero's 'new and unknown type of hydraulis.'

FIG. 7. From the Obelisk of Theodosius.

In contrast to Pollux' reference, the epigram on the pneumatic organ by Julian is well known:[22]

A strange growth of reeds (δονάκων) do I behold. Surely they sprang on a sudden from another, brazen field (χαλκείης ἀροῦρης), so wild are they. The winds that wave them are none of ours, but a blast leaps forth from a cavern of bull's hide and beneath the well-bored pipes travels to their roots. And a capable man, with swift-moving fingers (θοὰ δάκτύλα) of the hand, stands there and handles the keys (κανόνα, i.e., rod or lever) concordant with the pipes; then the keys leap lightly and press forth the melody.

This truly poetic comparison of the organ and a field of reeds is all the more remarkable since, as one of the manuscripts tells us, Julian wrote it in his youthful days before his apostasy in 361, when leaving the Church of the Holy Apostles in Constantinople. From this, one may well conclude that he had just listened to organ playing in that church.[23] It will be noticed that the 'brazen field' recurs in the previously quoted Latin poem of Claudius Claudianus. While this poem de-

[21] *Onomastikon*, IV, 70.

[22] Cf. Julian, *Opera*, III, 306 (tr. W. C. Wright, Loeb). A certain difficulty is presented by the words κανόνας συμφράδμονας αυλῶν of the original text. Wright translates this: 'the keys that pass the words to the pipes'; while Grove's *Dictionary of Music and Musicians* (3rd ed., New York, 1938), *s.v.* 'Organ,' p. 737a, has 'yielding rods of pipes.' The above translation was kindly suggested to me by Prof. Werner Jaeger of Harvard University. The version 'rods of pipes' is all the more unfortunate since the writer of the article draws from it the conclusion that the organ described by Julian 'had no keyboard.' Aside from the question of translation, it is impossible to think that an organ of the fourth century had no keyboard.

[23] Bittermann (p. 403, note 8) discusses this conclusion, but rejects it on the ground that 'the Eastern Church is against such a use of the organ' (i.e., its use in the church). It is true that Byzantine

scribes the hydraulis, there is a reference to the pneumatic organ in another poem of Claudianus, his *Epithalamium Laurentii*[24] where among the various instruments to be used for the wedding celebration we find *umida folligenis organa ventis*. Whether the simultaneous use of *umida* (humid, watery) and *folligenis ventis* (winds engendered by bellows) is a mere poetical license, or actually refers to a transitional instrument in which both water and bellows were used, it is impossible to say.

The earliest extant representation of a pneumatic organ is found on an obelisk at Constantinople, erected by the emperor Theodosius (died 395 A.D.). Fig. 7 shows a sketched copy of the stone relief. Naturally, each of the two youths should stand on a separate bellows, not both on the same. It should be noticed that the sketch shows some details which are hardly noticeable on the relief. Nevertheless, it furnishes conclusive proof that the pneumatic organ was well known in the early Byzantine empire. In this connection it may be mentioned that there is no foundation for the story, frequently reprinted, that the earliest type of pneumatic organ was one in which the wind 'was provided by two attendants who blew with their mouths alternately into pliable tubes.'[25] The only basis for this story is a sculpture, probably from the third or fourth century, in the Museum of Arles (reproduced, e.g., in Grove, *s.v.* 'Organ'); but this has been misinterpreted. It shows two men holding, not pliable tubes, but crudely modeled pump handles.

St Augustine (354–430 A.D.) speaks of the organ in two passages, both of which are important for a correct understanding of the term *organum:* '*Organum* is the name for all musical instruments, not only for that which is big and is inflated by bellows' and '*Organum* is the general name of all musical instruments (*vasorum*), although it has become customary (*jam continuerit consuetudo*) to use it properly for those which are inflated by bellows.'[26] In spite of the qualification contained in the latter passage, it appears that the mere word *organum* cannot be interpreted necessarily and unequivocally to mean the organ.[27] Such an inter-

sources tell us only about the use of the organ in the emperor's palace; but since these reports date from the eighth century at the earliest (see p. 204), they are hardly conclusive in the case under consideration.

[24] *Mon. Germ. Hist., AA*, x, 407, 62. The original text has *exclamat*, which Abdy Williams (see p. 191) translates (p. 6), after Gevaert, 'noisily emits.' The Latin word may suggest a loud sound, but certainly not a noisy one.

[25] See Grove (see note 22), v, 736a. The Arabic 'Muristus' treatise (see note 7) contains the detailed description (and drawing) of a pneumatic organ with twelve sounding pipes and blowing pipes for four (or, for increased strength and duration of tones, twelve) men (Farmer, pp. 63 ff.). Farmer maintains without proof that this type of organ 'is certainly much earlier than the instrument depicted on the Obelisk of Theodosius' (p. 70) and that 'it justifies the contention of other writers that in the earliest attempts the supply of wind was furnished by the mouth' (p. 72).

[26] *Patr. Lat.*, xxxvi, 671, and xxxvii, 1964. A similar remark occurs in the writings of Bede (*Patr. Lat.*, xc, 140).

[27] Of course, the ambiguity of the term *organum* extends much beyond the field of music. Thus, among the sources cited in Bittermann's article as evidence for the early use of the organ in connection with the church service in Gaul is a passage from Fortunatus' life of St Germain (*Mon. Germ. Hist., SS. Rer. Mer.*, vii, 382, 15). This passage, however, deals not with music, but with a sprained hand, which after proper treatment, is restored to its former use (*digitis redditur organum* [*organum* = *vivacitas*]).

pretation would seem admissible only if other instruments are expressly mentioned in addition to the *organum*, although even then the conclusion is not binding.

A passage contained in an *Epistola ad Dardanum* wrongly ascribed to St Jerome (*ca* 340–420 A.D.), has received considerable attention in mediaeval and modern writings. Since, however, its contents have often been misrepresented, there follows a translation:

At first I shall speak of the organ . . . . A cavity is made of two elephants' hides and this is filled [with air provided] by fifteen smiths' bellows. Through twelve brazen pipes it emits a grand sound, like thunder (*tonitrus*), so that it can be clearly heard everywhere up to one thousand paces (*per mille passum*) and more, like that organ of the Hebrews which, as is reported, was heard from Jerusalem to the Mount of Olives.

First, it will be noticed that the writer does not describe an organ at Jerusalem as is implied in modern quotations.[28] He describes an organ of his day, and it is obvious that any reference to an 'organ of the Hebrews' found in a source of the fourth or fifth century is devoid of documentary value. The most interesting statement contained in the passage is that regarding the tonal quality of the organ which the writer describes. As far as I can determine, here for the first time we hear about an organ having an unusually loud sound. To state this clearly is all the more important since most recent writers have shown a tendency to represent all the old organs, both ancient and early mediaeval, as being 'noisy' or having a 'thunderous quality.'[29] There is no foundation for such statements. Words like *magna murmura* or *tonitrus* should be evaluated in relationship to the aural level of early Christian days, which was certainly many decibels below that of the modern city or the modern orchestra. There is nothing extraordinary in the fact that the sound of an organ (placed in the open air) could be heard over a distance of a thousand paces, that is, of approximately 0.9 present-day miles.

A good description of the tonal quality, as well as the technical construction of the organ is found in the following passage from Cassiodorus (*ca* 470–570):[30]

The organ is a tower, constructed of divers pipes, which, blown by the wind of bellows, produce a very full sound (*vox copiosissima*); and that this sound may be properly varied, it is provided with certain wooden levers (*ligneis*) internally, which, skillfully handled by the fingers of the players, produce a grand and most charming music (*grandisonam et suavissimam cantilenam*).

Cassiodorus is the last of the Mediterranean writers to tell us of the organ, and for the ensuing three centuries we depend upon sources from Gaul and England for what little information is to be had. Probably the earliest of these sources

[28] See, e.g., Grove (see note 22), v, 737b: '. . . an organ at Jerusalem with twelve brazen pipes. . . . '

[29] Cf., e.g., Bittermann, p. 408: 'When one considers the many references to the thunderous quality of the early organ music. . . . ' Ten such references are listed in a footnote appended to this sentence, but of these only two justify the author's statement. One is Wolstan's report on the ninth-century Winchester organ (see p. 205); the other, a report of a late Arabic writer, Ikhwân al-Safâ. All the others are based on erroneous or exaggerated interpretations.

[30] *Patr. Lat.*, LXX, 1052.

are the writings of Venantius Fortunatus, bishop of Poitiers (born 530). Among his poems in which the organ is mentioned the one entitled *Ad clerum Parisiacum* is of particular interest, since it contains a vivid description of a crowd gathering in the early morning near the church:

From this side a youth plays an organ with small pipes, on the other an old man gives out (*ructat ab ore*) on a large trumpet; the sound of cymbals mixes with the shrill shawms (*calamis*); the soft pipe (*fistula*) sounds with dissimilar melodies (*disparibus tropis*); the children's flute (*tibia*) mitigates the rough drums of the old ones, and the song (*verba canora*) of the men mingles with the lyre. Here a melody lingers on gently, there another one moves swiftly: so varied are the efforts of the sexes and ages.[31]

Occasionally the word *organum* is found in the *vitae* of Gallic or British saints, but in view of Augustine's and Bede's remarks one cannot be certain that it always denotes an organ. Passages such as 'Magna nobis organa hodie religiosaque canent auspicia' (*Vita Episcopi Carnoteni*), 'Exaudi, petimus, organa, carmina' (*Vita Gengulfi*), 'organo spiritali se canente' (*Vita Wilfredi*), 'spiritalis et sanctus organarius' (*Vita Caesarii Episcopi*), and 'cum spiritalibus cymbalis et organis' (*Vita Desiderii*) are rather vague, and it is only with reservation that they are offered here as evidence for the use of the organ in the churches of Gaul and England during the sixth, seventh, and eighth centuries.[32] If we proceed from this surmise, we may note that the organ is nearly always called *religiosa* or *spiritalis*, obviously in order to raise it above the rank of the secular instrument to which, of course, the Church was opposed. Even the decidedly wordly cymbals were admitted after this process of canonization.

More graphic than the above short references is a description found in the *Vita Landeberti Episcopi Traiectensis Vetustissima*[33] on the occasion of the interment of a saint. After the body had been clothed in rich vestments and sealed in a sepulchre, 'then finally the choir of the psalm singers resounded back and forth, the spiritual cymbals crashed, the organ rang out in melodious and beautiful sounds (*canora suavissimaque modolatione*), and the entire population shook the town with their wailing.'[34]

[31] *Carmina*, II, no. 9. Fortunatus' 'organ with small pipes' (*organa exiguis cannis*) becomes in Bittermann's rendition (p. 404) a pipe organ which 'blares forth its ocean of sound from large pipes.' Charles Nisard, in his French translation of Fortunatus (*Collection des auteurs latins* [Paris, 1887]), questions in an annotation (p. 81) the trustworthiness of Fortunatus' account, saying that the instruments 'ne sont là que comme objets de comparaison avec les voix de chanteurs,' and adding the remark: "La musique des instruments n'était pas alors introduite dans les églises; elle ne le fut que vers l'an 1330.' Unquestionably, instruments, particularly the organ, were admitted in churches a long time before this date, and very likely were used in many places even before they were officially admitted.

Laistner (SPECULUM, v [1930], 218) makes a remark intended to correct Bittermann's interpretation of the passage from Fortunatus. It seems to me, however, that this remark should refer to Bittermann's rendition of the subsequent passage from Amalarius (p. 405).

[32] For the sources see Bittermann, p. 390, note 2. Gengulfus (died 760) worked in Burgundy; Wilfrid (634–709) in Northumbria; Caesarius (born 470) in Arles; Desiderius (died 608) in Vienna.

[33] St Lambert (died *ca* 700) worked in the Low Countries (*Traiectum*, i.e., Utrecht). *Mon. Germ. Hist., SS. Rer. Mer.*, VI, 380, 8.

[34] For the last sentence: *omnis populus urbem quatiebat gemitibus* Bittermann offers the following translation: 'All the people left the town on their knees' (p. 404).

One of the best-known and best documented events in the early history of the organ took place in the year 757, when an organ arrived in Compiègne as a gift to Pippin from the Byzantine emperor Constantinus Copronymus. All the annals mention this gift, some of them as the only event of the year.[35] Since this was unquestionably an elaborate instrument, fitting as a present from an emperor, there can be no doubt that organ building had been cultivated for a long time in Byzantium, probably uninterruptedly from the middle of the fourth century, the time when Julian wrote his inspired epigram on the instrument.

An interesting description of a Byzantine organ is found in the report of one Harun b. Jahja who was brought as a captive to Constantinople in 867. He tells us about 'a thing called *urqana*, shaped like an oil press, with sixty pipes partly covered with gold, and a bellows worked by three levers (crosses).' At a court festivity in 946 A.D., under the emperor Constantinus Porphyrogenitus, three organs were placed in a hall of the palace, a golden one in the middle, and two silver organs, one for the blue, the other for the green party, at the two sides. The golden organ was used for the ceremonies in honor of the empress, while the two others sounded in connection with the antiphonal singing of the polychronions for the emperor. It is not impossible that this Byzantine practice was the model for the installment of two organs in St Mark's Cathedral of Venice, planned on the model of the church of the Holy Apostles in Constantinople.[36]

In 812, emissaries of the Byzantine emperor Michael I Rhangabes brought to the court of Aix-la-Chapelle an organ the sound of which 'equalled the force of thunder, the liveliness of the lyre, the sweetness of the cymbals.'[37] Evidently the emissaries carefully guarded this as well as the other instruments they brought along, since Charlemagne ordered his workmen secretly to inspect the organ and to build one like it. Very likely this task, which indeed would have been very difficult, was never accomplished. Fourteen years later, however, an organ was built at Aix-la-Chapelle for Louis the Pious by a Venetian priest, Georgius,[38]

[35] See the references in Buhle, p. 57, note 3, and in Degering, p. 60, note 119 (see p. 191f).

[36] For both reports see E. Wellesz, *Byzantinische Musik* (Breslau, 1927), 17 ff. The Arabic report is also given in Farmer (see note 7), p. 59, where it is ascribed to Ibn Rusta.

Curiosities of some interest are the Byzantine 'organ trees,' such as that of the emperor Theophilus I (829–842) which is described by Michael Glykas (*Patr. Graec.*, CLVIII, 537) as a 'golden tree on which everywhere birds were seated which gave forth a sweet sounding melody.' Buhle (p. 67, note 5) calls attention to a similar instrument described by Liudprand (*Mon. Germ. Hist., SS.* III, 338, 7) as well as to a passage from the 'Younger Titurel' which forms part of his description of the temple of the Holy Grail and which appears to be a translation of Glykas' report (cf. F. Zarncke, 'Der Graltempel,' *Abhandl. d. sächsischen Ges. d. Wissensch., Phil.-Hist. Klasse*, VII [1879], 469, 105). These organ trees have an old ancestry, as appears from Hero's invention No. 44: 'Notes produced from Several Birds in Succession' (ed. Woodcroft, p. 67; see note 1).

[37] *Mon. Germ. Hist., SS.*, II, 751, 3. The often repeated tale of an organ sent to Charlemagne by Harun al-Rashid is without foundation. Cf. Bittermann, SPECULUM, IV (1929), p. 215.

[38] *Vita Hludovici imperatoris* (*Mon. Germ. Hist., SS.*, II, 629, 42); *Einhardi annales* (*ibid.*, I, 214, 44); *Einhardi Fuldensis annales* (*ibid.*, I, 359, 10); *Einhardi translatio SS. Marcellini et Petri* (*ibid.*, XV, I, 260, 16). Some of these reports call the instrument *organum hydraulicum* or *organum quod Graece hydraulica vocatur*. However, as has been pointed out above (note 20) this does not justify the conclusion that it was a water organ.

and Ermoldus Nigellus speaks of this achievement with obvious pride and satisfaction:[39]

That organ which France has never produced — a fact of which the Greek kingdom is boasting too proudly — and through which alone Constantinople has thought to surpass you, Caesar: now the court of Aix-la-Chapelle holds it.

Walafrid Strabo (died 849) speaks in a similar vein:[40]

'The great emperor may only wish, and whatever the poor world holds will come to his castle, even that organ of which Greece has been boasting more than of anything, but which the great king by no means counts among his greatest possessions.

Brief mention should be made of early organ building in England. The short reference, previously quoted, in the *Vita Wilfredi*, is complemented by more extended and more informative passages in the works of Aldhelm (*ca* 640–709). In his riddle on the organ he gives an impressive description of its superior tonal resources:[41]

> Buglers may blow curved horns of hollow brass
> And harps twang loud, and noisy trumpets blare,
> But from my vitals burst a hundred strains;
> My mighty voice makes mute the sounding strings.

A similar line of thought is developed in a passage from his poem *De Virginitate*:[42] 'If, however, somebody rejects the songs of the strings, and wishes something mightier than the plucking of chords, . . . and desires to feed the mind with grand music (*magno modulamine*), refusing to be satisfied with graceful song (*cantu gracili*): this man may delight his ear by listening to the great organ with a thousands blasts out of wind-filled bellows.'

If Aldhelm's enthusiastic praise of the organ can be assumed to express the general feeling of his countrymen, this would help explain what is often regarded as one of the strangest oddities in the history of organ building — the giant organ of Winchester. This was built under Bishop Elfhead (Elphegus Calvus, died 951) and has been described in considerable detail by the monk Wulstan (died 983) in a poem which forms the prologue to his *Vita S. Swithuni*. Although often quoted, this account is important enough to be reproduced here in a complete, and partly revised, translation. After a description of the new church building which the bishop had erected, Wulstan says:[43]

[39] *In honorem Hludovici*, IV, 639 ff. (*Mon. Germ. Hist., Poet. lat. aevi Carol.*, II, 76).

[40] *Carmen de imagine Tetrici*, 128 ff. (*Mon. Germ. Hist., Poet. lat. aevi Carol.*, II, 384).

[41] Cf. J. H. Pitman, *The Riddles of Aldhelm* (New Haven, 1925), p. 10.

[42] *Mon. Germ. Hist., AA.*, XV, 355, 66. For other references, see *ibid.*, pp. 292, 15; 424, 1716; 466, 2785. H. Handschin, 'Zur Geschichte der Lehre vom Organum' (*Zeitschrift für Musikwissenschaft*, VIII [1925/26], p. 321 ff.) mentions these passages of Aldhelm in a more or less loose connection with organum, that is, early vocal polyphony. However, words like *flabris*, *folligenis*, and *quinquagenis et terquinis vocibus* clearly point to the organ in three of these passages. Only the one on p. 424: 'Quamvis armoniis praesultent organa multis musica,' is ambiguous.

[43] Mabillon, *Acta SS. O. B.*, scl. v, p. 630. A well-known translation of this passage, given by F. D. Wackerbarth in his *Music and the Anglosaxons* (London, 1837), pp. 12–15, and copied by Grove, Audsley, and others, is not entirely satisfactory, particularly in the lines:

To these you have added an organ, erected on a double ground, such as is seen nowhere. Twice six bellows above are ranged in a row, and fourteen lie below. These, by alternate blasts, supply an immense wind, and are worked by seventy strong men, labouring with their arms, covered with perspiration, each inciting his companions to drive the wind up with all their strength, that the filled box may speak with full breath through its four hundred pipes, arranged in one row, which the hand of the organist (*organici ingenii*) governs. Here he opens the closed ones, or closes the open ones, as the fixed melody (*certa camaena*) of varied sound requires. Two brethren of concordant spirit sit there, and each manages his own alphabet. There are, moreover, hidden holes (*foramina*) to the forty slides (*lingua*), and each [slide] has ten [holes] in due order. Here some [slides] move forward, there others backward, sustaining the single notes through their sounds. They strike the joyful sound of the seven different notes, mixed with the song of the lyric semitone. Like thunder the iron voice batters the ear, so that it may receive no other sound. So much does it sound and resound, that every one stops with his hand his gaping ears, being unable to bear from near by the din which the various voices produce. The music of the pipes is heard throughout the town, and the flying fame thereof is gone out over the whole country. Such an adornment has thy solicitude vowed to the *Ecclesia tonans*, and erected in honor of the key-bearing St Peter.

With this instrument an epoch of organ building came to its acme and conclusion. Nothing more is heard of giant organs or of instruments with a loud sound. The organ builders of the ensuing centuries cultivated small organs, the portative and the positive, and it is not until the early fifteenth century that a new trend towards bigger and more powerful organs becomes discernible.

II

After this account of the evolution of the organ through more than twelve hundred years of its existence, the question may well be raised as to what music was played on these instruments. As is well known among musicologists, the earliest music which can definitely said to be written for the organ dates from the early part of the fourteenth century.[44] Therefore, more than fifteen hundred years of organ playing remain for us a closed book. Do we have to resign ourselves to this? Is it not possible that our rather detailed knowledge of the instrument may also reveal something about the music that was played on it? I hope to be able to throw a few rays of light into this darkness, sufficient to make some of the main contours dimly discernible.

Our main evidence in this question is the body of known facts concerning the

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Suntque quaterdenis occulta foramina linguis
Inque suo retinet ordine quaeque decem:
Huc aliae currunt, illuc aliaeque recurrunt
Servantes modulis singula puncta suis.

These Wackerbarth translates: 'There are, moreover, hidden holes in the forty tongues, and each has ten (pipes) in their due order. Some are conducted hither, others thither, each preserving the proper point (or situation) for its own note,' adding the remark: 'I do not know how else to translate these sentences.' They are indeed difficult to understand, and in presenting my version, I should like to make a similar reservation.

[44] The so-called Robertsbridge Codex, London, Brit. Mus., *Add. 28550*, containing estampies and arrangements of motets. See, e.g., W. Apel, *The Notation of Polyphonic Music, 900–1600* (Cambridge, 1942), pp. 37 ff.

playing mechanism of the old organs. As previously explained, the Greek hydraulis, as described by Hero, had a remarkably developed playing mechanism. It had hinged keys which could easily be depressed and which were automatically returned to their normal position by means of springs. There is no doubt that these instruments could be, and actually were played in a manner not dissimilar to the playing of a modern organ or, more likely, of organs of the fifteenth and sixteenth centuries, that is, mainly with the second, third, and fourth finger, and without the thumb. This conclusion is supported by various reports which emphasize the light action of the instrument and the finger agility of the players. Thus, Optatianus says that 'at the least movement the levers open the pipes'; Claudian speaks of 'light touch' and 'nimble fingers'; while Julian and Cassiodorus mention the finger activity in connection with the pneumatic organ of their days. Is it unreasonable to conclude from these facts that the music sounding on these organs was just as 'nimble' and 'swift' as was the finger action — that, consequently, it had a character entirely different from what modern writers want us to believe when they tell us about the 'noisy' and 'thunderous' organ of early times? Perhaps it is permissible to think that originally Greek organ music was not dissimilar to their vocal music, and that later, particularly in Rome, it took on a certain virtuoso character, somewhat like Oriental oboe music of the present day.

Having gone so far in my 'conclusions,' I shall go a step further and try to make a case for the surmise that two-part music was performed on the Greek organs. Again, the main argument is one of common sense: is it thinkable that for many hundred years players should have sat down before a keyboard very much like that of our day, without trying to use both hands in simultaneous sounds? Whether the *imparibus modis* of the *Aetna* or Tertullian's *commercia modorum* can be adduced as support for such a surmise, it is difficult to say. But it seems to me that the previously quoted passage from Athenaeus' *Deipnosophistae* clearly supports such a view, since the speaker calls the music of the hydraulis *symphonia* and contrasts it favorably with that of the *monaulos*. The existence in Greek music of that primitive type of concerted music known as 'heterophony' is generally conceded, chiefly on the basis of a passage in Plato's *Laws*.[45] Actually, what Plato describes is much more than heterophony in the present sense of the word (i.e., a free doubling of a melody in another voice part), since he explains it as involving different intervals, pitches, rhythms, and numbers of notes. There can be no doubt that a kind of true polyphony, similar in nature to that encountered in Oriental music, was known in Greece as early as Plato's times. Obviously, no instrument would have lent itself better to further experimentation and progress in *symphonia* than the organ.

Long after I had reached such conclusions, I happened upon a passage in Hawkins' *A General History of the Science and Practice of Music* (London, 1776)[46] which merits attention. Starting with the remark that Guido of Arezzo, in his

[45] *Laws*, VII, 812 D-E. See C. Sachs, *The Rise of Music in the Ancient World* (New York, 1943), pp. 256 ff. for an excellent account of Greek polyphony.

[46] II, p. 163.

Micrologus of *ca* 1020, speaks of the organ 'as an instrument to which the hymns, antiphons, and other offices were daily sung,' Hawkins goes on to say:

> It is scarce credible that during so long a period as between 800 and 1020, during all which the world was in possession of the organ, neither curiosity nor accident should lead to the discovery of music in consonance. Is it to be supposed that this noble instrument, so constructed as to produce the greatest variety of harmony and fine modulation, was played on by one finger only? . . . Perhaps it may be objected that this argument will carry the use of symphoniac music back to those times in which it is asserted no such thing was known; for it may be asked, does not the hydraulic organ mentioned by Vitruvius as necessarily presuppose music in consonance, as that in use at the time of Guido's writing the *Micrologus?* In answer to this it is said that the hydraulic organ is an instrument so very ill defined that we are incapable of forming to ourselves any idea of its frame, its construction, or its use.

Today we are extremely well informed about the frame and the construction of the hydraulis, and nothing prevents Hawkins' conjecture from becoming a distinct possibility, perhaps more so in the case of the hydraulis than in that of the organs in Guido's time.

In fact, whatever notion one may chose to form about the organ music of ancient Greece and in the Mediterranean countries up to the fifth century, there can be no doubt that an entirely different type of music was sounded on the Western organs of the eighth and later centuries. The main reason for this contention is the fact that these had an entirely different playing mechanism, a much more clumsy one. They lacked the hinged keys as well as the spring mechanism of the Greek and Roman organs. Instead, the slides were simply made somewhat longer to stand out in front of the sound-board and this projection served in the capacity of a key. The organs were played, therefore, not by depressing a hinged key, but by pulling out and pushing in the entire slide. This, of course, could not be done by a finger movement. The whole hand had to be used for each movement of the slide.

Many illustrations of early Western organs show the long slides, and two of them, both reproduced here (Figures 8, 9) clearly illustrate the manner in which these were operated. The question as to why and when the older, much more advanced, keyboard action was abandoned, and the new one adopted, cannot be answered with certainty. Since in all probability the Western organs were constructed after Byzantine models, it is reasonable to suppose that these also had pulling slides. It would follow, then, that some time after Julian (who evidently describes a 'finger' organ) the hinged keys were abandoned in Byzantium in favor of pulling slides. The only explanation I can offer for this development in reverse is that it was the concomitant of a trend towards increased size and wind pressure. Great pipes and strong wind pressure require a more advanced type of lever action, and it was not until the thirteenth or fourteenth century that a solution to this problem was found.

However this may be, it is obvious that the only kind of music which could be performed by pulling slides, was a succession of sustained notes. Both hands had to be used in alternation, one pushing in a slide at the moment when the other pulled out a new one. It is interesting to notice that music consisting of a

FIG. 8. Bible of St Etienne Harding (11th cent.) Library of Dijon.

Fig. 11. Utrecht Psalter.

succession of sustained sounds has existed from time immemorial almost to the present day in China. Often huge orchestras, including zithers, lutes, mouth organs, oboes, drums, bells, and chimes joined in performing the 'instrumental hymns' of the Chinese emperors.[47] Quite possibly, instrumental hymns of a similar character, performed on the organ, cymbals, and lyres, sounded in the palaces of the Byzantine and Frankish rulers. Quite possibly, too, some such music was also performed in the church to accompany processions or for other ceremonials.

FIG. 9. Pommersfelden, Gräfl. Schönborn'sche Bibliothek, *Cod. 2776* (11th cent.) Buhle, *op. cit.*, Tafel 14.

The illustration from the Harding Bible gives a pictorial description of such a concert, performed by an organ, a set of bells, an oboe, and a fiddle. It will be noticed that letters are written on the organ to identify the keys. From numerous sources we know that from the ninth through the twelfth centuries the letters from A to G were used on organs, bells, and other instruments to indicate the C-major scale, from C to B.[48] There also exist a number of hymns provided with

[47] For an example, see A. T. Davison and W. Apel, *Historical Anthology of Music* (Cambridge, 1946), No. 1. I found a welcome support for this comparison (which may appear rather far-fetched to some readers) in C. Sachs' recent book, *The Commonwealth of the Arts* (New York, 1946). Speaking of the parallel organum of the ninth century (see p. 211) he describes this as a music 'in which a liturgical melody solemnly proceeds in notes of equal, considerable length (like the hymn to Confucius in China)' (p. 65).

[48] Cf. H. Riemann, *Studien zur Geschichte der Notenschrift* (Leipzig, 1878), pp. 28 ff. and Beilagen 1–16. Also G. Reese, *Music in the Middle Ages* (New York, 1940), pp. 135 ff. It will be noticed that the letters (or, more likely, the pipes) of the Harding organ are in wrong order.

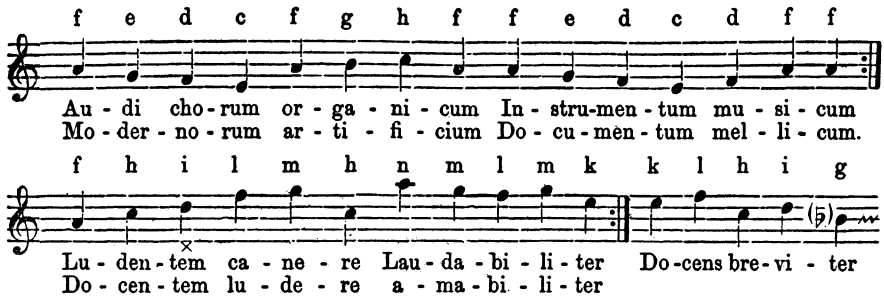
such letter notation, and one of these, from the twelfth-century *Cod. Engelberg*, 1 *4/23*, is of particular interest for us, since the text refers to the organ. We may well assume that it was sung by a chorus, in unison with the organ and, possibly, other instruments:

f e d c f g h f f e d c d f f
Au - di cho - rum or - ga - ni - cum In - stru-men - tum mu - si - cum
Mo - der - no - rum ar - ti - fi - cium Do - cu - men - tum mel - li - cum.
f h i l m h n m l m k k l h i g
Lu - den - tem ca - ne - re Lau - da - bi - li - ter Do - cens bre - vi - ter
Do - cen - tem lu - de - re a - ma - bi - li - ter

FIG. 10. Transcription from *Cod. Engelberg*, 1 *4/23* (12th cent.)
Buhle, *op. cit.*, p. 99.

It is impossible, in an account of early organ playing, to pass over the much debated question as to a relationship between the organ and that early type of polyphony which, from the early ninth to the end of the twelfth century, was known as *organum*. The existence of such a relationship has been emphasized by A. Gastoué, who, in his essay 'Moyen Age'[49] says: 'Il est impossible de ne pas voir que les deux parties primitives de l'*organum* vocal sont une imitation du chant à deux voix exécuté sur les claviers de l'*organum*, instrument à eau ou à vent. . . . ' However, the prevailing view today denies such an origin of vocal polyphony, and explains this as the result of some vocal practice.[50] As far as I can see, scholars holding this view have not availed themselves of a fairly conclusive argument, the fact that the primitive keyboard mechanism of the organs of this period obviated the playing of more than one key at a time. Since therefore two-part music was impossible on these instruments, the organ and organ playing cannot have any connection with the *organum*.

Was it impossible? Not, I believe, if two players were employed. There are two documents providing convincing evidence that such a practice existed. One of these is the famous illustration from the Utrecht Psalter (Fig. 11). Evidently, the instrument shown here is a double organ, with two sets of pipes, two separate blowers each handled by two men, and two players each of whom seems to incite his pumping assistants to greater efforts. Equally conclusive is the report about

[49] In A. Lavignac, *Encyclopédie de la musique* (Paris, 1914), I, i, 572. Later on, Gastoué mentions a 'texte plus haut cité' as evidence for two-part organ playing in the fifth century. Very likely he refers to a passage on p. 557 according to which 'Augustin, dans l'explanation du ps. 150' says: 'L'auteur y a ajouté l'orgue, non pas pour que chaque instrument sonne en son particulier, mais pour qu'ils s'accordent en divers consonances, comme on le fait avec l'orgue . . . . ' Unfortunately, I have been unable to locate this interesting quotation. It is not in the *Enarrationes* to Ps. 150. I should be grateful for further information on this matter.

[50] A good survey of the different views on this question is found in Reese, pp. 249 ff. (see note 48).

the Winchester organ on which 'two brethren of concordant spirit' were playing, 'each managing his own alphabet.' Considering all the facts, it appears that the music performed on these instruments could hardly have been anything but what is well known to us from the earliest extant sources of polyphonic music, the *Musica* and *Scholia enchiriadis* of the ninth century.

If our conclusion is correct, it gives considerable support to the theory that early Western polyphony is derived from organ practice. The following is an attempt to substantiate this view and to indicate a possible line of development. I am fully aware of the fact that it does not constitute proof beyond doubt.

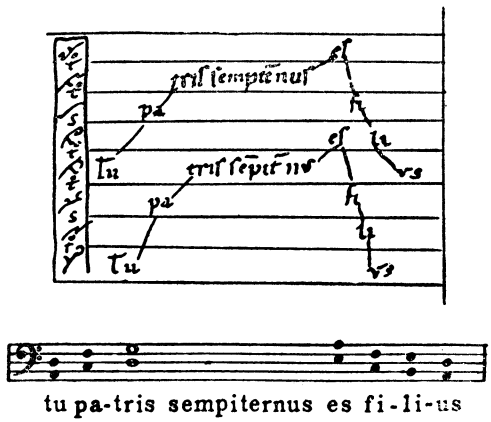


FIG. 12. *Musica Enchiriadis* (9th cent.). Original notation and transcription. W. Apel, *The Notation of Polyphonic Music, 900–1600* (3rd ed., Cambridge, 1945), pp. 204, 205.

Mediaeval scholars are agreed that the Utrecht Psalter, although written in the eighth or ninth centuries, goes back to Byzantine models of a considerably earlier date. The organ of the Utrecht Psalter (obviously a hydraulis), therefore, can be said to represent a Byzantine instrument of, we may say, the fifth or sixth century. The illustration does not show the keyboard mechanism, but the whole scene does not suggest anything in the nature of *thoa daktyla*. The considerable size of the instrument, the small number of pipes, the strenuous efforts of the men working the pumps and trying to produce and maintain a high pressure, the fact that four men are required to keep eight pipes alive — all these considerations justify the conclusion that this organ was operated by slides. It therefore stands at the beginning of the road to loud and powerful organs which finally led to the Winchester organ. Since the instrument is played by two men, a reasonably good case can be made for the theory that some kind of two-voiced organ music, consisting of a succession of sustained notes, was practiced in Byzantium in the sixth century. If the details of the illustration can be trusted, each voice part was limited to four notes, the tetrachord of ancient Greek theory.

In the middle of the eighth century the Byzantine organ was introduced into France, where its arrival was heralded as an event of unusual importance. Is it permissible to venture that the Copronymus organ was a double organ like that

of the Utrecht Psalter, perhaps one with a pneumatic instead of a hydraulic wind supply? If it is admitted, on the basis of the evidence from the *vitae* of the saints mentioned previously[51] that the organ was known in Gaul as early as the sixth or seventh century, it would be difficult to understand the sensation caused by the arrival of the Byzantine organ, unless this was an entirely different type of instrument, with increased tonal resources. Possibly, the organ of 812 also was a double organ in the Greek manner,[52] and such an assumption would explain the feeling of achievement expressed by Ermoldus and Strabo when Frankish organ builders finally succeeded in erecting a 'Greek organ,' in other words, an instrument on which two-part music could be performed. The Winchester organ would then represent the English counterpart of these new ventures in organ building.

The conclusion to be drawn from these premises is that Western polyphony derived from Byzantine organ music. According to this explanation, some such term as *musica ad organum* would originally have denoted two-voice music played on the Byzantine double organ (possibly in combination with other instruments), and would later have been applied to vocal music of a similar character. A well-known passage in support of this view, although it is of a considerably later date, is found in the treatise of the English writer Johannes Cottonius who flourished about 1100: 'This manner of singing is commonly (*vulgariter*) called *organum*, because the human voice, if singing in two parts (*apte dissonans*), shows similarity to the instrument which is called organ.'[53]

Byzantine origin of Western polyphony is also suggested by the fact that all the examples of this style in the *Musica* and *Scholia enchiriadis* are written in the so-called Dasian notation, the Greek Byzantine origin of which is apparent beyond doubt.

If the above explanations are accepted, the year 757 would become one of the most important landmarks in the history of music, indicating the beginning of Western polyphony. It is easy to understand that this new musical style should soon have been transferred from the organ to the vocal field. While the ornate passages and 'Oriental' melismata of Gregorian chant always presented great difficulties to the Frankish singers, they may have been delighted to find in the Byzantine organ music a model which they could easily imitate. We can imagine that the basic simplicity of this music was as welcome to their throats as was its novel sound to their ears.[54] This type of music also offered many possibilities of modified or amplified performance. Voices could be used together with the organ,

[51] See above, p. 203.

[52] Possibly, such a construction would also explain that passage of the report in which we are told that this organ could produce sounds 'as loud as thunder, as lively as the lyre, as sweet as cymbals (*rugitum quidem tonitrui boatu, garrulitatem vero lyrae, vel cymbali dulcedinem coequabat*).

[53] Gerbert, *Scriptores ecclesiastici de musica sacra potissimum* (San-Blasianis, 1784), II, 263.

[54] In 787, we are told by the monk of Angoulème (*Patr. Lat.*, CXXII, 638), Charlemagne brought Roman singers with him who instructed the Frankish singers in the new art of singing: 'Similiter erudierunt romani cantores supradictos cantores Francorum in arte organandi.' This report, by the way, clearly refutes the claim of a 'Nordic' origin of polyphony which has been put forward by some German writers.

other instruments could be added when available, the voices could be doubled in octaves (as is expressly described in the *Musica* and the *Scholia*), or one part could be performed by singers, the other by the organ. The last-mentioned possibility, which would no longer require a double organ, may have been particularly common, judging from the terms *vox principalis* and *vox organalis* used in the *Musica enchiriadis*. The former term denotes the original melody, usually a hymn, the latter, the contrapuntal melody added above the other according to the principles of parallel organum in fourths or fifths.

As has been pointed out in our account of organ building, the great 'double'

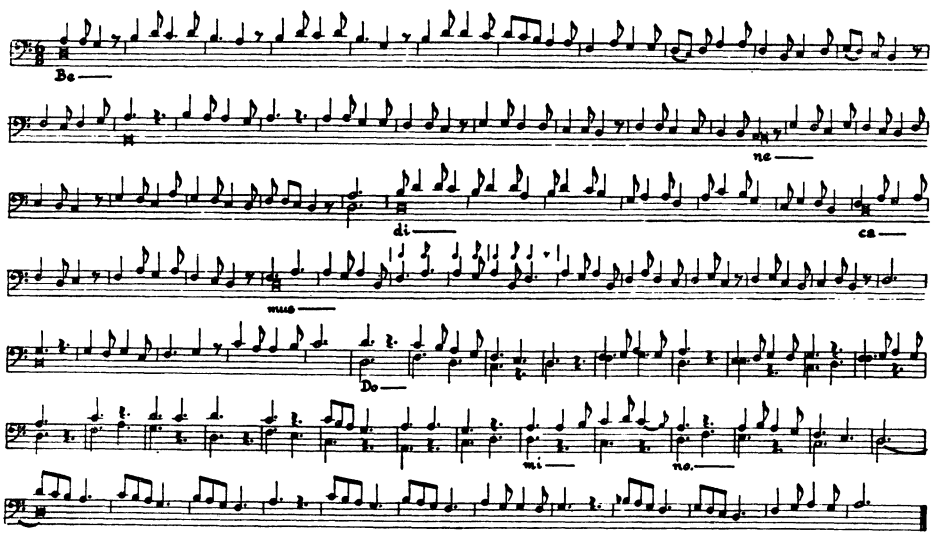



FIG. 13. Two-voice Organum, School of Notre Dame, *ca* 1175 (period of Leoninus). A. T. Davison and W. Apel, *Historical Anthology of Music* (Cambridge, 1946), No. 28 c.

organs were replaced, about 1000, by smaller instruments for a single player who, by pulling and pushing slides, could perform a single succession of sustained notes. Such instruments were suitable for playing the *vox organalis* of the parallel organum or of the 'free organum' of the eleventh century which employs contrary motion and in which the *vox organalis* is usually below the *vox principalis*. They could also be used for the extended pedal points[55] which occur in the tenors of the two-voiced organa of the twelfth century (School of St Martial, *ca* 1150, and School of Notre Dame, Leoninus, *ca* 1175 [Fig. 13]), as well as in the organa in three or four parts of Perotinus (around 1200, [Fig. 14]).

In compositions of this type there are lengthy sections in which the lower part (the liturgical tenor) consists of a small number of long sustained notes each of

[55] A thirteenth-century term for such sustained tenor notes of indefinite length is *organicus punctus* (Franco, *Ars cantus mensurabilis* [E. Coussemaker, *Scriptorum de musica medii aevi nova series* (Paris, 1864), I, 133]). Although Franco mentions the term in connection with vocal polyphony, it is, of course, possible that it found its way into this terminology *via* the organ.

which sounds against extended melismatic passages in the upper voice or voices. Sustained notes of twenty or more measures in duration naturally present quite a problem from the singer's point of view, all the more since these organa were performed, not by the full choir but by a small group of specially trained soloists, the so-called *cantores*. The organ, on the other hand, is the most natural medium for the rendition of these 'organ points.' The most famous example of this style

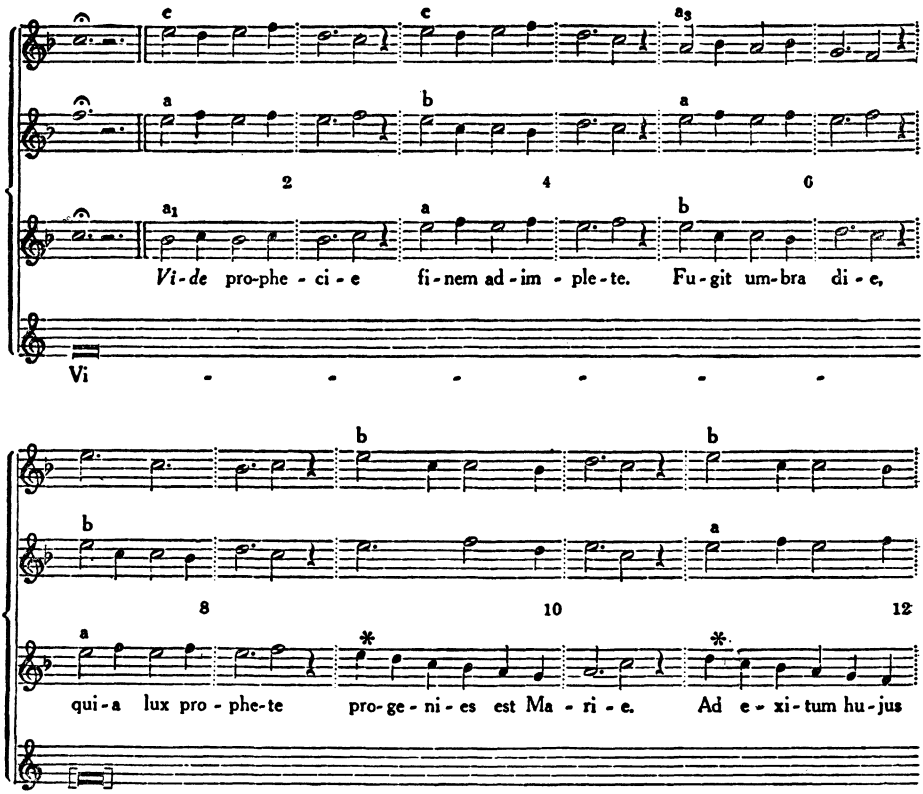



FIG. 14. Perotinus, Four-voice Organum 'Viderunt omnes,' *ca* 1200. G. Adler, *Handbuch der Musikwissenschaft* (Berlin, 1929), p. 229.

is Magister Perotinus' four-voice Christmas organum *Viderunt omnes* of about 1200. This opens with a section of about 200 measures during which the tenor sounds a continuously sustained tone on *f*, while the three upper voices move along in contrapuntal lines — truly an 'F-major toccata of the thirteenth century,' as it has been called with reference to the great organ composition by Bach. In fact it is almost impossible to imagine how tones of such a stupendous duration could ever have been performed without the support of an organ. We say 'support of an organ' because it is unlikely that the organist was allowed to take over these tenor parts completely, to the exclusion of the vocalists. The mere fact that

text syllables are provided for the single notes shows that they were intended to be sung. Moreover, these tenor parts are always liturgical melodies borrowed from the most solemn items — graduals, alleluias or responsories — of the Gregorian chant. Certainly, a purely instrumental performance of these melodies would have constituted a departure from tradition such as the dogmatic mind of the period is not likely to have tolerated. Duplication of the singer's part on the organ, however, may well have proved an acceptable compromise between the demands of tradition and the exigency of the musical practice.

It has been suggested that, in the two-voiced melismatic organa of the St Martial (or Compostela) type, the florid upper part was performed on the organ, since this was the *vox organalis* added to the liturgical *vox principalis* in other

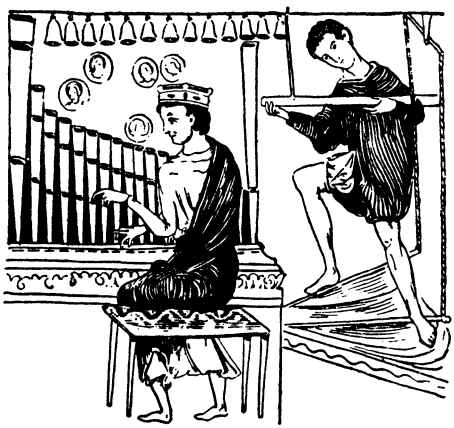


FIG. 15. Belvoir Castle, Psalterium (13th cent.) Buhle, *op. cit.*, Tafel 14.

words, the tenor.[56] Obviously, the performance of such a melody would require an organ with a finger action, and this leads us to the question as to when the cumbersome slide action of the early mediaeval organs was replaced by a more advanced action which was operated by the fingers.[57] The earliest illustration showing this manner of playing is found in a thirteenth-century psalter from Belvoir Castle (Fig. 15). However, a much earlier evidence exists in a treatise of the tenth century, the so-called 'Berner Tractat' *De fistulis organicis quomodo fiant.*[58] in which the anonymous author gives directions for the construction, not only of the pipes, the chest, and the wind supply, but also of the playing mechanism. The most interesting fact about the last-named description is that it is,

[56] See. G. Frotscher, *Geschichte des Orgelspiels* (Berlin, 1935), I, 52.

[57] The often repeated story that at some time organs were played with the fist rests on a rather weak foundation, the only evidence being a passage in M. Praetorius, *Syntagma* (Wolfenbüttel, 1618), II, 97. Since Praetorius, on the whole, is a conscientious chronicler, it may be assumed that there were some organs so poorly and heavily constructed as to require such a manner of playing. Nothing, however, justifies the assumption that this was the usual method.

[58] Buhle, pp. 66 and 114.

beyond doubt, an imitation of that contained in Hero's *Pneumatica*. We find here the same elastic slips of horn (*ex cornu semicirculi*) fastened to a fixed rod (*in quodam ligno ante capsam firmo*), as well as wooden keys (*lamina*) provided with an iron pin which is connected with the horn by means of a iron wire. Hero's detailed description of the lever mechanism is missing, but even without this it is sufficiently clear that the organ of the anonymous of Bern had a lever action. There is repeated mention of *lamina* (keys) as distinguished from the *linguae*

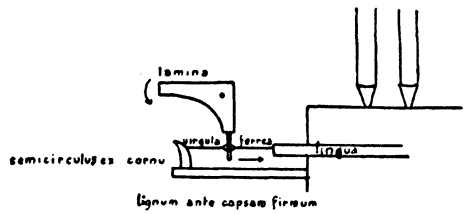


FIG. 16. Key mechanism according to the *Berner Tractat* (10th cent.) Buhle, *op. cit.*, p. 80.

(slides), and particularly clarifying is the reference to *depressa lamina* and *laxa lamina*, that is, depressed and released keys: 'The iron wire is fastened to the slip of horn and the slide in such a way that upon depressing of the key the whole slide is pushed in . . . , while upon the release of the key the slide is pulled out to the middle of the first hole' (Fig. 16). The organ had fifteen keys, on which the alphabet from A to G was written twice, so that 'the player could see more quickly which key (here the word *lingua* is used) to touch.'

Thus we have reason to believe that a highly important advance in organ construction and organ playing was brought about as one of the various results attend-

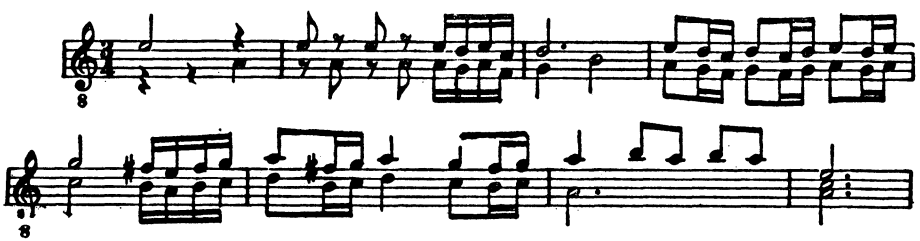



FIG. 17. Estampie, Robertsbridge Codex, 14th cent. W. Apel, *The Notation of Polyphonic Music*, p. 40.

ing the proto-Renaissance of Greek antiquity. After a long period of experimentation in other directions, organ building finally took up the threads of a remote past without ever losing them again. Not only could florid melodies be performed on these organs, but also polyphonic compositions in two or three parts, such as are found in the Robertsbridge codex mentioned at the beginning of this chapter.[59]

[59] See note 44.